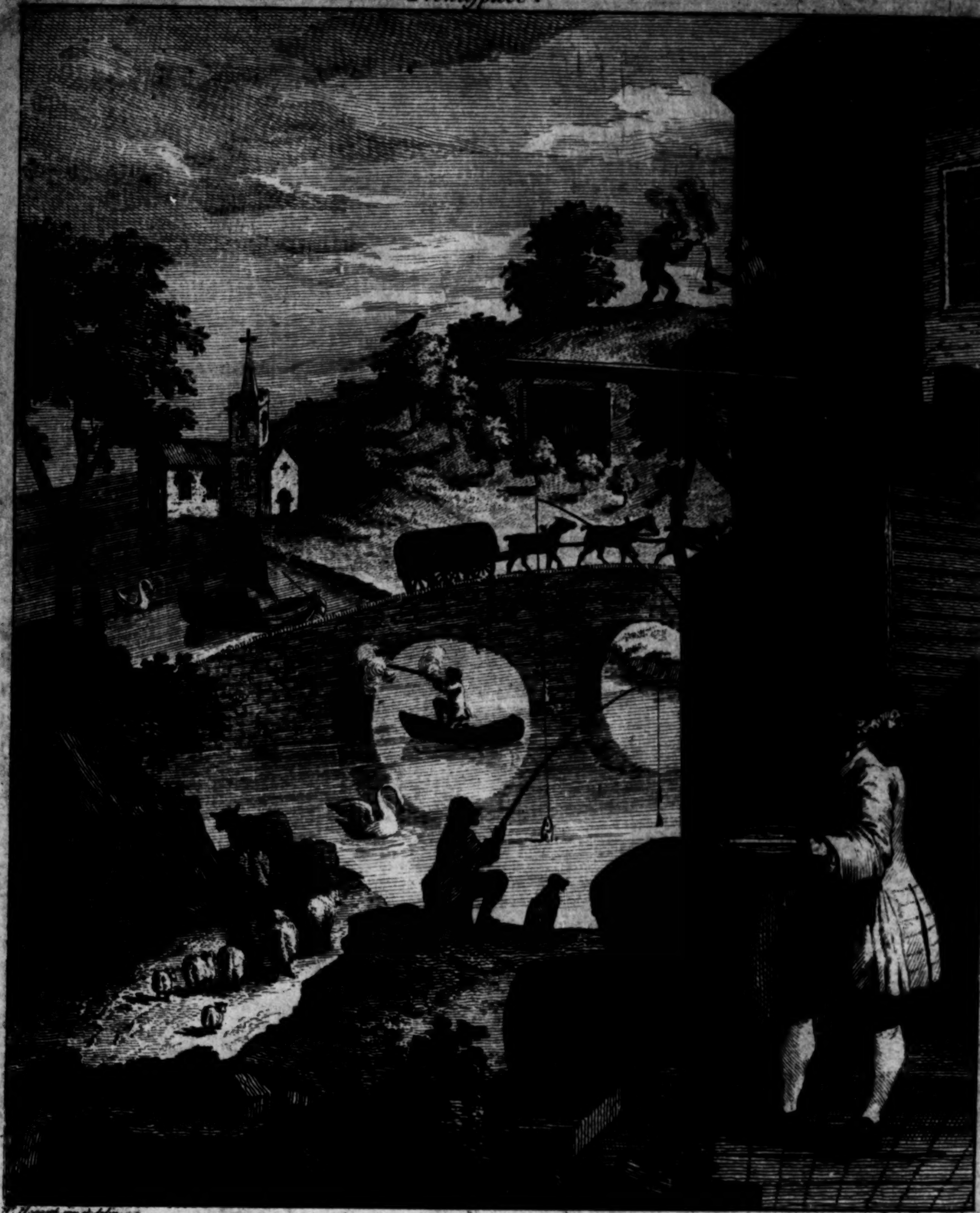
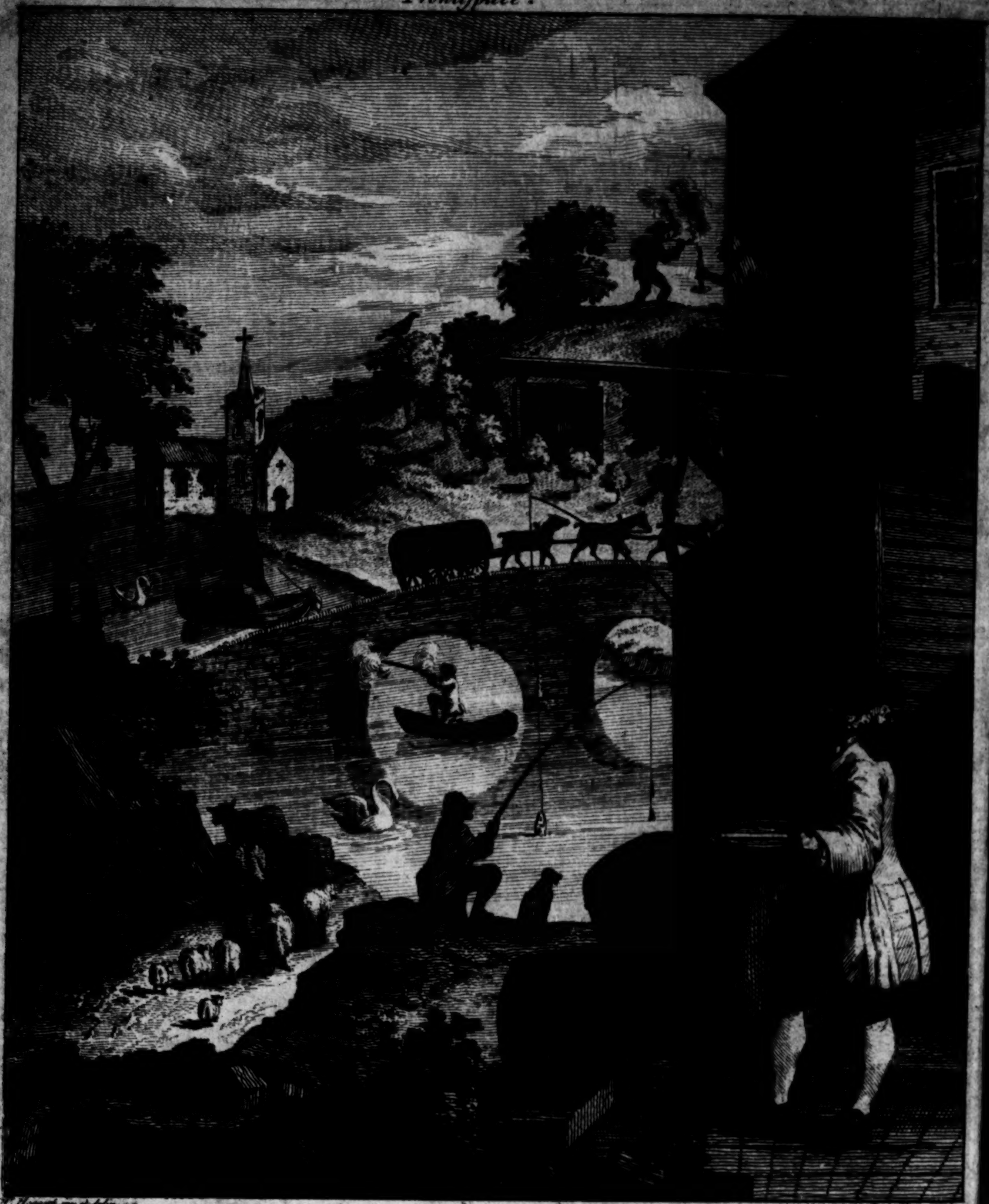
Frontiſpiece.



W. Hogarth inv. et delin. L. Sullivan sculp.

Whoever makes a DESIGN *without the Knowledge of* PERSPECTIVE*.*
will be liable to such Absurdities as are shewn in this **Frontiſpiece.**

Frontiſpiece.



W. Hogarth inv. et delin. L. Sullivan Sculp.

Whoever makes a DESIGN *without the Knowledge of* PERSPECTIVE *will be liable to such Abſurdities as are ſhewn in this* **Frontiſpiece.**

Dr. *BROOK TAYLOR*'s
METHOD of
PERSPECTIVE
Made Eaſy,
Both in THEORY and PRACTICE.
In TWO BOOKS.

—K

Kirby (J. J.)

K

BEING
An Attempt to make the ART of PERSPECTIVE eaſy and familiar;
TO
Adapt it intirely to the ARTS of DESIGN;
AND
To make it an entertaining STUDY to any GENTLEMAN who ſhall chuſe ſo polite an Amuſement.

By JOSHUA KIRBY, PAINTER.

Illuſtrated with Fifty COPPER PLATES; moſt of which are Engrav'd by the AUTHOR.

> *The Practice* [of Painting] *ought always to be built on a rational Theory, of which* PERSPECTIVE *is both the Guide and the Gate, and, without which, it is impoſſible to ſucceed, either in Deſigning, or in any of the Arts depending thereon.*
>
> Leonardo da Vinci upon Painting, p. 36.

BOOK I.

IPSWICH:
Printed by W. CRAIGHTON, for the AUTHOR; and Sold by him in *Ipſwich:* And in *London*, by *J. Swan*, near *Northumberland-Houſe*, in the *Strand*; *F. Noble*, in *King's-Street*, *Covent-Garden*; and *J. Noble*, in St. *Martin's Court*. MDCCLIV.

BRITISH MUSEUM

TO

Mr. HOGARTH.

SIR,

IF your extenſive Knowledge and Genius in the Arts of Painting did not entitle you to a Dedication of the following THEORY of PERSPECTIVE, the great Obligations which I am under for your Friendſhip and Favour, would claim not only this, but every other Token of my Gratitude and Affection. But this Work in a peculiar Manner has a Right to your Patronage and Protection, as it was YOU who firſt encouraged me to write upon the Subject: And if it has any Merit, the Publick, in a great Meaſure, are obliged to you for it.

I ſhall not follow the common Method of Dedicators, by attempting a Panegyrick upon your amiable Qualifications; which might appear like Flattery, and offend your Modeſty: I ſhall only beg Leave to ſay, that your own inimitable Performances are greater Inſtances of your Genius in the Arts of Deſign, your Knowledge of the Human Paſſions, and your Contempt of Vice and Folly, than it is in my Power to expreſs; and that,

I am, SIR,

With the greateſt Eſteem and Gratitude,

Your moſt obliged,

And obedient Servant,

JOSHUA KIRBY.

1 JY 64

Directions for placing the Plates.

FRONTISPIECE.

BOOK I.

Plate I, II. to front Page	6
III.	14
IV.	19
V. VI.	24
VII.	28
VIII. IX.	32
X.	36
XI. XII. XIII.	42
XIV. XV. XVI.	50
XVII.	54
XVIII. XIX. XX. XXI.	64
XXII.	78

BOOK II.

I.	8
II. III. IV. V.	20
VI. VII.	28
VIII. IX. X. XI.	40
XII.	48
XIII. XIV. XV. XVI. XVII. XVIII.	58
XIX. XX. XXI.	64
XXII. XXIII.	74
XXIV. XXV.	80
XXVI. XXVII.	84

ERRATA.

ERRATA.

BOOK I.

PAge 3, line 36, for ADC read BDC——p. 5, l. 25. for AF read BF——ibid l. 26, for FC, EG read FD, ED.——p. 6. l. 6. for AB, read AC.——l. 11, for *any* read *the.*——l. 12, for AB read AD, and for AD in D, read AB in B—— l. 16. put a Comma between C, D.—— l. 23, for AB read ab.---p. 7. l. 9, read *many equal parts*——p. 24. l. 7, for *Lines* read *Line*——p. 25, l. 4, for ABTO, read ABTS —— l. 6. for ABCO, read ABTS ——l. 7, AO, BC, read AS, BT——l. 23, for OB read SB——p. 29, l. 7, for TDE, read TPE——p. 32, l. 26, for *is* read *are.*——l. 31, put a Comma between A, B.——l. 32, put Comma's between H, C, L,——l. 37, for 25, read 59——p. 33, l. 5, for AB, read AD—p. 35, l. 9, for L. read B,——l. 23, for 𝔈L read EL——p. 40, l. 27, for C read ℭ, and for CE read ℭ𝔈——l. 32, for *their* read *the.*—p. 44, l. 5, for OGLP, read DGLP.—p. 46, l. 26, for Xz, read XZ——p. 49, l. 29, for C read c—p. 58, l. 9, for ABCD, read ABOD. —l. 14, for ABCD, read ABOD.—l. 26, for R read A—p. 64, l. 22, for 89, read 62.—l. 26, for AE read AB—l. 27, for Fig. 80, read 81.—p. 70, l. 6. for *longer* read *larger.*—p. 76, l. 39, read *of* A *to* L.

BOOK II.

PAge 6, l. 10, and 14, read *Repreſentations of the Sides of all Objects*---p. 7, l. 9, for K read k---p. 17, l. 9, for GI, read GL---l. 16, for h read e---p. 23, l. 33, for CL read CD ---p. 26, l. 27, put a Comma between H, L---p. 27, l. 36, for a k, read a h---p. 31, l. 8, for AB read AC---l. 22, for a g read a b---p. 32, l 22, for *Perpendiculars* read *Perpendicular*---p. 36, l. 19, for d e read d g---p. 39, l. 2, for a e read a c---p. 40, before l. 19, put Fig. 39---l. 24, for *one* read *each*---p. 41, l. 13, for 49, read 4q---l. 19, put a Comma between ef and cd---p, 46, l. 17, for *at*, read *from*---p. 47, l. 2, for LV, read LU,-- p. 51, l. 28. for 1 read I.---p. 54, l. 12, for o read v---l. 21, *from the Corner Column* read *the Center of the Corner Column.*---p. 55, l. 37, for *Depth by* B4, read *Depth* B4---p. 56, l. 7, for *Points*, read *Point*, and a Comma between H, L.---p. 57, l. 11, for *Height* read *Heights.*---p. 62, l. 29, for *parallel* read *fartheſt*---l. 39, for B6, read Bb---p. 78, l. 18, for sa, read ca,---l. 34, for E reed H---p. 79, l. 3, for a c, read a a---p. 80, l. 12, for If, read In.

1 JY 64

⁂ *The Author begs the Favour of his Readers to correct the* Errata, *before they begin to read the Book.*

A LIST *of* SUBSCRIBERS.

N. B. Thoſe Names mark'd thus * *are* Members *of the Academy of* Painting, Sculpture, Architecture, *&c. in* London.

A

Nathaniel Acton, Eſq;
Mr David Adkinſon
Mr Allen, Painter.

B

John Bagnall, Eſq;
William Baintun, Eſq;
Mr Andrew Baldrey, Painter
Mr John Barnard, Ship-builder
Mr. Chriſtopher Barry
* Mr James Baſire, Engraver
John Battie, Eſq;
Mr John Bayley, Engraver
The Rev. Mr Charles Beaumont
Mr James Bencraft
The Rev. Mr Ralph Blois
Mr William Blois
* Mr Jacob Bonneau, Drawing-Maſter, 6 Books
Mr Thomas Bowell
Mr Edward Bowman
Mr. Bernard Broadbelt
Mr Richard Brompton, Painter
Philip Broke, Eſq;
Mr John Browne
Mr Joſeph Browne
Mr Daniel Browne
Mr Nathaniel Bucke
James Burrough, Eſq; F. R. S.
The Rev. Mr. Robert Buxton
Mrs Ann Buxton

C

Turner Calvert, Eſq;
The Rev. Mr Philip Carter
The Rev. Mr Samuel Carter
Mr Thomas Carter, Statuary
* Mr Charles Catton, Painter
* Mr William Cazal, Drawing-maſter
Richard Charlton, Eſq;
* Mr Charles Cheere
The Rev. Mr Chriſtian
Mr William Clarke
Mr William Clarke
The Rev. Mr Henry Cloſe
Mr Butler Clowes, Engraver
The Rev. Mr John Clubb
Mr Francis Coates, Painter
Thomas Coggeſhall, Eſq;
The Rev. Mr Daniel Copland
Mr Henry Copland, Engraver
* Mr William Collins, Statuary
Mr Joſeph Cooper, jun. Painter
Mr John Corniſh, Painter
Mr William Craighton
Mr Edward Crane, Painter
Philip Creſpigny, Eſq;

D

The Right Hon. Earl of Dyſart
John Dade, Eſq;
Mr William Dade, Fellow of Pembroke Hall, Cambridge
* Mr Richard Dalton, Painter

Mr Eleazer Davy
Henry Dawſon, L. L. D.
Mr Arthur Devis, Painter
* Mr John Donowell, Architect

E

Theodore Eccleſtone, Eſq;
Mr John Eccardt, Painter
Mileſon Edgar, Eſq;
Robert Edgar, Eſq;
Mr William Elſden, Carver

F

Sir Cordal Firebrace, Bart.
Mr Joſeph Finley
Mr. Zacheriah Fiſke, Painter
Mr William Fokard
Mr Ingham Foſter
Mr Richard Francklin.

G

MrThomas Gainſborough, Painter
Mr Thomas Gardner
Mr John Gorham
Mr John Gravenor
Mr James Green
* Mr Charles Grignion, Engraver
Joſeph Grove, Eſq;
* Mr John Gwyn, Architect

H

Mr Hailſtone
Mr Hamilton, Architect
Mr William Hammond
Mr William Hammond
Mr Hammond, Painter
Mr Hannan, Painter
Robert Harland, Eſq;
Mr William Havard
Mr Canham Hart
Mr Joſiah Harris
* Mr Francis Hayman, Painter
* Mr Richard Hayward, Statuary
Mr Nathaniel Hedges
The Rev. Mr. Thomas Hewett
Mr Joſhua Highmore, Painter
Mr Edward Highmoor
Mr John Hingeſtone
The Rev. Mr Robert Hingeſtone
The Rev. Mr Peter Hingeſtone
Benjamin Hoadley, M. D.
Mr William Hoare, Painter
* Mr Hogarth, Painter, 6 Books
Rowland Holt, Eſq;
* Mr Nathaniel Hone, Painter
Mr Peter Houltum, Painter
The Rev. Mr Henry Hubbard, Fellow of Emmanuel College, Cambridge
Mr Thomas Hudſon, Painter
Mr Hunt.

I

Mr Samuel Jacomb
Mr Jeffreys
Mr Thomas Jolly
Henry Iſaacs, Eſq;
Mr Richard Jupp, jun.
Mr Batholomew Juſtinier

K

Sir John Kemp, Bart.
* Mr William Keable, Painter, 3 Books
Samuel Kent, Eſq;
Mr Samuel Kilderbee
Mr Dover Kilderbee
Mr William Kirby
Mr Knapton, Painter

L

Sir Richard Lloyd, Knt.
Mr George Lambert, Painter
Mrs Lancaſter

Mr Robert Lane
Offley Lewis, Eſq;
Mr William Leſlie
Richard Savage Lloyd, Eſq;

Library of
- Catherine Hall
- Corpus Chriſti College
- Emmanuel Col.
- Jeſus College
- St Peter'sCollege
- Trinity College

Cambridge

The Rev. Roger Long, D. D. Maſter of Pembroke Hall, Lowndes's Profeſſor of Aſtronomy, and F. R. S.
Mr J. Lovatt
William Lynch, Eſq;

M

* Mr James M'Ardell, Engraver
* Mr Robert Maberly, Painter
Mr Jonathan Mallet
Mr Marquand, Architect
Mr Thomas Martin, F. A. S.
Mr Joſeph Martyr
The Rev. Mr Maſterman
Mr John Manning
Mr John Meadowe
John Middlemore, Eſq;
Mr Charles Middleton, Chaſer
* Mr J. S. Müller, Engraver
Robert Milner, Eſq;
Mr James Morris
* Mr G. M. Moſer, Chaſer
Mr Benjamin Morris
Mr Thomas Mulliner.

N

The Right Rev. Lord Biſhop of Norwich
The Hon. Richard Savage Naſſau, Eſq;
* Mr F. M. Newton, Painter
Mr Nichols
Mr Edward Nickſon
Mr Robert Stiles Norman

O

Robert Onebye, Eſq;
Mr John Oldfield, Writing-Maſter
Mr Thomas Oſborne, Bookſeller

P

* Mr James Paine, Architect
Mr John Palgrave
Mr Thomas Palmer, Plaiſterer
Mr John Parſons
Mr Robert Parſons, Carver
Mr Francis Patton, Engraver
Mr Thomas Patty, Carver
Mr Francis Perry
Mr A. Pond, F. R. S.
Mr Peter Pullyn
Mr Robert Pyle, Painter

R

His Grace the Duke of Rutland
Sir John Rous, Bart.
Mr Benjamin Radcliffe
Humphry Rant, Eſq;
Mr John Redgrave, Architect
The Rev. Mr William Reeve
Mr E. Reeves, Carver
John Revett, Eſq;
Mr William Richards
* Mr Edward Rooker, Engraver
Mr F. L. Roubiliac, Statuary
Capt. Robert Rowning
The Rev. Mr Tobias Ruſtatt

S

* Mr Samuel Scott, Painter
Mr Scullard
Mr Seldon
Mr Seton, Engraver

* John Shackelton, Eſq; principal Painter to his Majeſty
John Sheppard, Eſq;
Mr Seton
Mr George Silverſide
Mr Thomas Singleton, Carver
Mr John Slarke, Painter
Mr John Simpſon
Mr John Simmons, Painter
Mr Henry Smart
Robert Sparrow, Eſq;
Thomas Staunton, Eſq;
Mr Stevens
Mr Luke Sullivan, Engraver, 4 Books
Mr JohnSwan,Bookſeller,6 Books.

T

Right Hon. Lord Talbot
Major Taylor
Philip Thickneſs, Eſq;
Michael Thickle, Eſq;
Mr Samuel Trew
Mr N. Tucker, Painter

V

The Right Hon. Lord Villieres
Hon. Edward Vernon, Eſq;
E. Venn, M. D.
The Rev. Mr Edward Ventris
Mrs Sarah Unett.

W

* Mr Sam. Wale, Painter, 4 Books
Mr Charles Walford
* Mr A. Walker, Engraver
John Warburton, Eſq; Somerſet Herald, and F. R. S.
Mr Francis Warden, Plaiſterer
Juſtly Watſon, Eſq; Engineer
Mr Weecks
Mr Wieland, Chaſer
Mr Benjamin Wilſon, Painter and F. R. S. 4 Books
Roger Wilſon, Eſq; Grays-Inn
* Mr James Wills, Painter
Mr Wolfe, Architect
Mr Joſeph Wood, Engraver

Y

* Mr Yeo, Engraver
Mr R. Young.

1 JY 64

PREFACE.

THE *many Treatiſes already publiſhed upon* PERSPECTIVE, *may make it appear needleſs to augment the Number; it is therefore neceſſary to give the Reaſons that induced me to undertake ſuch a Work.*

The Deſign of the following Treatiſe, is, by exhibiting a NEW SYSTEM OF PRACTICAL PERSPECTIVE, *to make this hitherto intricate, but uſeful Art, eaſy and familiar to every Capacity: And to dreſs it in the moſt ſimple Garb; that its Parts may be clearly ſeen, and its whole Deſign (ſo far as it relates to Painting, &c.) eaſily underſtood. For certain it is, that no Subject hath been treated in a worſe Manner than this, notwithſtanding the many Volumes which have been wrote upon it; ſome purely Mathematical, and therefore unfit for the generality of Perſons who are concerned in the Arts of Deſign; and others wholly Mechanical, made up of incoherent Schemes, unapplicable Examples, and ſuch a Confuſion of unneceſſary Lines, as tend only to puzzle and diſcourage the Learner. My Intention, therefore, is, to ſteer between the abſtruſe mathematical Reaſoning of ſome, and the tedious and falſe Explications of others; and from thence to produce a Syſtem of Perſpective upon certain and ſimple Principles, eaſy to be underſtood and applied to Practice.*

This is a general Account of the following Work; which is the Product of ſeveral Years Study and Application: And how I have ſucceeded in the Attempt, is ſubmitted to the Candour of every ingenuous Reader. But that ſuch an Undertaking was neceſſary, is ſufficiently teſtified by the many eminent Painters, and other curious Artiſts, who perſwaded me to proſecute my Deſign, and have generouſly encouraged the Publication of this Work.

I have intitled this Treatiſe DR. BROOK TAYLOR'S PERSPECTIVE, &c. *out of Gratitude to that ingenious Author, for furniſhing me with Principles to build upon; and becauſe his, though a very ſmall Pam-*

phlet, is thought the moſt correct, conciſe, and comprehenſive Book upon the Subject. I have not proceeded exactly in his Method; for that was not agreeable to my Plan: Nor have I explained his Propoſitions, Theorems, &c. in a regular Manner; ſince that alſo was inconſiſtent with the Order of my Work: But I have had Regard to his Principles in general, ſo as to make his Meaning more intelligible, and that kind of Perſpective of more univerſal Uſe. This Book of Dr. TAYLOR'*s was firſt publiſhed in the Year* 1715, *and was intitled* LINEAR PERSPECTIVE; *and in the Year* 1719 *he publiſhed another ſmall Tract, which he called,* NEW PRINCIPLES OF LINEAR PERSPECTIVE; *and which he intended as an Explanation of his firſt Treatiſe. But, notwithſtanding both theſe Treatiſes are ſo curious and uſeful, few have been able to underſtand his Schemes; and when they have underſtood them, have been as much puzzled in applying them to Practice. And in the Year* 1738, *Mr.* Hamilton *favoured the World with two Volumes in Folio, intitled* STEREOGRAPHY, *which he has explained in the Manner of Dr.* Taylor, *and which, though a very curious Work, and worthy the Peruſal of every good Mathematician, yet, I may venture to affirm, that but very few of thoſe Perſons who are Students in the Arts of Deſign can comprehend it; and were they qualified with a ſufficient Stock of Mathematical Knowledge, it would take up more Time than they either could, or would chuſe to ſpare. However, I muſt frankly acknowledge, that I think it the beſt Syſtem of* Perſpective Projection[*] *that ever was, or, perhaps, ever will be, made publick; and I ſhould be very ungenerous in not confeſſing that it has been of great Service to me in ſeveral Parts of my Work; and that I am indebted to it for ſome Things which I ſhould never have thought of, had not that ingenious Gentleman pointed them out to me; and I hope, that this publick Acknowledgment will prevent the Imputation of Plagiariſm, and be a ſufficient Satisfaction for the Liberties which I have taken with his Work.*

---

[*] PERSPECTIVE PROJECTION comprehends not only Perſpective, which relates immediately to the Arts of Deſign, but alſo, all kinds of mathematical Projection whatſoever; ſuch as the Projection of the Sphere, the Cylinder and its Sections, Conick Sections, and the like.

The Plan which I have proceeded upon in the Proſecution of my Deſign, is this: I have divided the whole Work into two Books; the firſt I have called A COMPLEAT SYSTEM OF PERSPECTIVE, *which contains the Theory and its Application to Practice; and the ſecond,* THE PRACTICE OF PERSPECTIVE, *which contains the practical Part only. This Method of treating the Subject ſeemed to me the moſt eligible; becauſe there are ſome who do not like to take Things for granted, but chooſe to be convinced by Demonſtration, and to have the Reaſon of Things explained upon certain Principles. For ſuch, I intend the firſt Book; and for others, who either want Time or Capacity to go regularly through the Theoretical Part, I have wrote the ſecond Book; that ſuch Perſons may be enabled to determine the Appearance of all Kinds of Objects upon the Picture with the greateſt Eaſe and Expedition: So that the whole together (if I am ſo happy as to have ſucceeded in my Attempt) may be called a compleat Syſtem of Perſpective, ſo far as it relates to the Art of Painting, &c.*

In the firſt and ſecond Chapters of the firſt Book, I ſuppoſe my Reader a mere Novice, not only in Perſpective, but in every Thing which it is neceſſary he ſhould know as previous thereto; and therefore I have begun with an Explanation of Mathematical Inſtruments, and have ſhewn their different Uſes; after which I have explained a few Geometrical Definitions and Propoſitions, and from thence I have proceeded to ſhew how to deſcribe (in a mechanical Manner) ſuch Geometrical Figures as may occur in the following Work. And becauſe Perſpective is an Optical Science, I have given ſome ſhort Abſtracts from the moſt eminent Writers upon Opticks; by which Means the unlearned Reader will have a general Notion of the Eye and the Nature of Viſion, the Reflection and Refraction of the Rays of Light, and of the Cauſe of Colours. I ſay the unlearned Reader, becauſe I do not preſume to give Inſtructions to Perſons who are well acquainted with the Mathematicks or Philoſophy, but only to ſuch as are ignorant in theſe Matters, but are nevertheleſs deſirous of ſeeing the Foundations upon which Perſpective is built; and therefore, all that hath been hitherto advanced, may be omitted by the learned Part of my Readers, as an imperfect Abſtract of what they are infinitely better acquainted with than myſelf.

The Third Chapter of the ſame Book begins with an Introduction to Perſpective, which I have endeavoured to explain in a familiar Manner, by ſuch Objects as we are every Day converſant with; and then I have proceeded to the Theory, which I have ranged under the following Heads, viz, 1. Of Objects which are in Planes perpendicular to the Picture; 2. Of Objects which are in Planes perpendicular to the Ground; *And* 3. Of Objects which are in Planes inclined to the Ground; *becauſe there are no other Situations in which Objects can be diſpoſed; that is, they muſt be either perpendicular, parallel, or inclined: And every Example which I have produced, is immediately applied to Practice; and by that means the Theory and Practice are ſo cloſely connected, that they ſerve to explain each other, and to fix both very ſtrongly in the Memory.*

And thus having explained the Theory and general Practice of Perſpective, I have in the fourth Chapter of the ſame Book, conſidered the different Kinds of Perſpective, viz. when the Picture is either perpendicular, parallel, or inclined. The perpendicular Picture is what is commonly made uſe of, and is placed perpendicular to the Ground; the parallel Picture is placed parallel to the Ground, (ſuch as Ceilings, and the like;) and the inclined Picture, is ſuppoſed to be inclined to the Ground, and is rather more curious than uſeful. I have next given an eaſy Method of determining the Repreſentation of any Objects upon Domes, vaulted Roofs, and other uneven Surfaces, by means of Reticulation or Net-Work; which is all that is contained in this Chapter. The fifth Chapter of the ſame Book contains the Perſpective of Shadows, both in Theory and Practice; and this I have treated in the very ſame Manner as I have done the Perſpective of Objects: So that what is contained in this Chapter, is deducible from what hath been already advanced in the third Chapter, and follows like ſo many Corollaries from thoſe general Propoſitions. The ſixth Chapter of the ſame Book contains ſome general Inſtructions for chooſing a proper Diſtance for the Eye, &c. and the bad Effects of viewing a Picture from any other than the true Point of Sight; and the ſeventh and laſt Chapter, is principally copied from Mr. Hamilton, *and contains an Explanation of Aerial Perſpective, the* Chiara Oſcura, *and keeping in Pictures.—And thus having gone through the Theoretical Part, I have pro-*

proceeded to the ſecond Book, which contains the practical Part only; in which I have obſerved much the ſame Order and Method as in the Theory, and therefore that needs no farther Explanation.

The Figures I have made choice of, to demonſtrate and explain this Syſtem of Perſpective, are not ſet off with Ornaments, to attract the Eye, but are done with Simplicity, to inform the Underſtanding; and are ſuch as every common Mechanick has clear and determinate Ideas of, and conſequently of the moſt univerſal Uſe: For the SQUARE, *the* TRIANGLE, *and the* CIRCLE, *are not only the Foundation of moſt geometrical Figures, but are alſo the ſimple Materials of Shapes in general, and of which regular Buildings, in particular, are always compoſed. And I may, without the leaſt Arrogance, affirm, that, had the ſeveral Writers upon Perſpective ſhewn how to find the Repreſentations of thoſe three Figures only, upon different Planes, and in various Situations, their Works would have been more intelligible, and of much more Service, than they now are with ſuch a Multiplicity of ornamental Schemes and unapplicable Examples. In ſhort, the Principles of Perſpective are few and ſimple, and therefore to explain them by a vaſt Number of ornamental Figures, would ſerve only to divert the Eye and miſlead the Judgment, and to make that appear obſcure and difficult, which in its own Nature is extremely clear and eaſy.*

And here it may not be improper to obſerve, that the Learner is deſired to draw out every Figure as he proceeds, which will ſerve to fix them in his Memory, and to make their Explanations more eaſy and familiar to him. It is a Method I have always practiſed myſelf, with Succeſs; and therefore think it may be of Service to others: However, thoſe who by an extraordinary Capacity can carry on a long Train of Ideas together, and can recollect, compare, and combine them as they pleaſe, need not give themſelves this Trouble.

This is a general Account of the following Work: But before I quit the Subject, I ſhall beg leave to ſay ſomething upon the Uſefulneſs of Perſpective to every Perſon that is any ways concerned in the Arts of Deſign, and to recommend the Study of it in particular to every TYRO *in the Art of Painting; which I could wiſh might put a Stop to that Ridicule and*

Contempt with which it has been treated by a ſort of People, who are too ready to condemn a Branch of Science, which they have neglected to gain a ſufficient Knowledge of. Theſe Perſons bring to my Mind a Story of Leonardo *da* Vinci, *a famous Italian Painter who flouriſhed in the latter End of the fourteenth Century*[*]. *He tells us, that a Friend of his, named* Boticello, *had a peculiar Pique againſt Landſkips, thought them much beneath his Application, and looked upon them in a moſt contemptible Light: But, ſays* Leonardo, *the Reaſon was, becauſe he was a very ſorry Landſkip Painter: And our Author adds, that for this Reaſon his Merit in other Matters was the leſs regarded.*

That Perſpective is an eſſential Requiſite in a good Painter, is atteſted by all our moſt eminent Artiſts, and is moreover confirmed by almoſt every Author [†] *who has wrote upon Painting; nay, the very Term Painting implies Perſpective. For to draw a good Picture is to draw the Repreſentation of Nature, as it appears to the Eye; and to draw the Perſpective Repreſentation of any Object, is to draw the Repreſentation of that Object at it appears to the Eye: Therefore the Terms Painting and Perſpective ſeem to be ſynonymous, though I know there is a critical Difference between the Words. Yet this will ſerve at leaſt to ſhew the near Alliance between Painting and Perſpective; that if the one doth not comprehend the other, Perſpective, however, may be ſaid to be the Baſis upon which Painting is built; and therefore he who attempts to paint a Picture without having a general Knowledge of it, will always wander in the Mazes of Uncertainty, be ſubject to the greateſt Errors, and his Works, like thoſe of* Boticello, *will be the leſs regarded. And what is ſaid of the Uſefulneſs of Perſpective to Painters in particular, may be applied to Artiſts in general, ſuch as Engravers, Architects, Statuaries, Chaſers, Carvers, &c. It will alſo be an entertaining Study to any Gentleman, who has either a Taſte for Drawing, or is a Lover of Painting; as it will enable him to draw out the Repreſentation of any Building or Proſpect, and to form a tolerable Judgment of a Picture without any other Aſſiſtance. I would not be underſtood to mean, that a*

---

[*] Vid. *Leonardo da Vinci* upon Painting, p. 31.

[†] Ibid. p. 29. *Freſnoy*'s Poem upon Painting, p. 19, v. 115. And *Du Piles* upon Painting, Chap. 18.

Perſon is always to follow the rigid Rules of Perſpective, for there are ſome Caſes in which it may be neceſſary to deviate from them; but then he muſt do it with Modeſty, and for ſome good Reaſon, as we have ſhewn in ſome Parts of this Work. Nor would I be thought to deſire the Artiſt to make Uſe of Scales or Compaſſes upon all Occaſions, and to draw out every Line and Point to a Mathematical Exactneſs; no, the Deſign of this Work is quite the Reverſe; it is to teach the general Rules of Perſpective, and to enforce the Practice of it by eaſy and ſelf-evident Principles; *to aſſiſt the Judgment, and to direct the Hand, and not to perplex, either by unneceſſary Lines or dry Theorems. Upon the whole: He that has a true Genius, and will take Pains to learn the Principles delivered in this Treatiſe, will be taught to* SEE *Objects with ſuch Exactneſs, and his Judgment will be founded upon ſuch ſolid Principles, that he will be enabled to draw out any Repreſentation with more Eaſe, and with much more Correctneſs, than the greateſt Genius who is ignorant of Perſpective, or he who deſpiſes the Rules of ſuch a neceſſary Art.*

1 JY 64

CONTENTS.

Compleat SYSTEM of PERSPECTIVE.

BOOK I.

CHAP. I.

Containing Matters previous to Perſpective.

SECT. I.

Of Inſtruments *uſed in* Drawing, —— —— Page 1

SECT. II.

Geometrical *Definitions and Propoſitions*, —— —— —— 2

SECT. III.

Practical Geometry, —— —— —— 5

CHAP. II.

Some Optical Obſervations.

SECT. I.

Of the Eye *and the Nature of* Viſion, —— —— 8

SECT. II.

Of the Reflection *and* Refraction *of the* Rays *of* Light, —— 15

SECT. III.

Of the Cauſe *of* Colours, —— —— —— 18

CHAP. III.

The Theory of Perſpective.

SECT. I.
Introduction *to the* Theory *of* Perſpective, —— Page 20

SECT. II.
Definitions, Theorems, *&c.* —— —— —— 26

SECT. III.
Of Objects *that are in Planes* perpendicular *to the* Picture, 30

SECT. IV.
Of Objects *that are in Planes* perpendicular *to the* Ground, 33

SECT. V.
Of Objects *that are in Planes* inclined *to the* Ground, —— 37

CHAP. IV.

Of parallel and inclined Pictures.

SECT. I.
Of the Parallel Picture, —— —— —— 43

SECT. II.
Of the Inclined Picture, —— —— —— —— 47

SECT. III.
Of Vaulted Roofs, Domes, *&c.* —— —— —— 51

CHAP. V.

The Perſpective of SHADOWS.

Introduction *to the* Theory *of* Shadows, — Page 56

SECT. I.

Of Shadows projected *by the* Sun, — — 57
General Rules *applied to* Practice, — — — 63

SECT. II.

Of Shadows projected *by the* Candle, *&c.* — — 65

CHAP. VI.

Containing ſeveral eſſential Requiſites.

1. *Of the* Diſtance *of the* Eye, — — — 66
2. *Of the* Height *of the* Eye, — — — 67
3. *The* Conſequence *of* viewing *a* Picture *from any other than the* true Point *of* Sight, — — — 68
4. *Of the* Size *of the* Picture, — — ibid.
5. *Some Conſiderations upon the* Appearance *of* round *or* cylindrical Objects *upon the* Picture, — — 69

CHAP. VII.

Of Aerial Perſpective, *the* Chiara Oſcuro, *and* Keeping *in* Pictures, — — — — 74

BOOK II.

The PRACTICE of PERSPECTIVE.

* * *

CHAP. I.

Introduction *to the* Practice *of* Perſpective, —— Page 5

CHAP. II.

SECT I.

To PREPARE *the* PICTURE, *&c.*

1. *Of the* Size *of the* Picture, — — — 9
2. *For the* Height *of the* Eye, — — ibid.
3. *For the* Diſtance *of the* Eye, — — — 10

SECT. II.

To find the Repreſentation of Objects which lie flat upon the Ground, ſuch as the SQUARE, *the* TRIANGLE; *and the* CIRCLE, *&c.*

1. *Of the Projection of a* Point;—*by two Methods,* - - - - 11
2. *Of a* Line *that is* perpendicular *to the* Picture; *by 2 Methods.* 12
3. *Of a* Line *that is* parallel *to the* Picture;—*by two Methods.* ib.
4. *Of a* Line *that is* oblique *with the* Picture;—*by two Methods.* 13
5. *Of an* Equilateral Triangle, *when one of its Sides is* parallel *to the* Picture;—*by three Methods.* — — ib.
6. *Of an* Equilateral Triangle, *when all its Sides are* oblique *with the* Picture;—*by three Methods.* — — 15
7. *Of a* Geometrical Square, *having ſome of its Sides* parallel *to the* Picture;—*by three Methods.* — — ib.
8. *Of a* Geometrical Square, *having all its Sides* oblique *with the* Picture;—*by three Methods.* — — 16
9. *To find the Repreſentation of a* Square *of any determinate Width,* — — — — 17
10. *Of a regular* Hexagon;—*by two Methods.* — — 18
11. *Of* Circles;—*by three Methods.* — — 19

SECT.

SECT. III.

To find the Repreſentation of Objects that are perpendicular *to the* Ground.

1. *Of a Plane* perpendicular *to the* Picture, — Page 21
2. *Of Planes* parallel *to the* Picture, — — 22
3. *Of Planes* oblique *with the* Picture, — — 23
4, 5. *Of Triangular* ſolid *Figures,* — — — 24
6, 7. *Of* Cubes *and* Parallelopipeds, — — 25
8. *Of* Hexangular *Figures,* — — — — 27
9. *Of* Octangular *Figures,* — — — ib.
10. *Of* Cylindrical, *or round Objects,* — — 28

SECT. IV.

To determine the Repreſentation of Objects that are inclined *to the* Ground.

1. *Of a* Square;---*by three Methods.* — — 29
2. *To find the* vaniſhing Lines *and* vaniſhing Points *of a* Roof, 31
3. *To find the Appearance of a* Square *by the vaniſhing Points of its Diagonals;---by three Methods.* — — 33
4. *General Rules for* Roofs, *and other inclined Objects,* ------ ib.
5. *General Rules for the* Projection *of the* Regular Solids, *&c.* viz. 36
------ *of Cubes reſting upon one Edge only,* — — ib.
------ *of a Cube ſtanding upon one Corner only,* — — 37
------ *of a regular Tetrahedron,* — — — 39
------ *of a Canted Cube,* — — — 40
6. *Of the* Double Croſs, — — — 41

CHAP. III.

The Practice of Perſpective abbreviated.

SECT. I.

General Rules, *&c.* — — 42
1. *When any vaniſhing Point is* out *of the* Picture, *to draw a Line that ſhall tend to that Point,* — — ib.

2. *To*

2. *To make one Line equal to another Line given,* Page 43
3. *To cut off a Line in any given Proportion,* —— —— ib.
4. *To prove if an Object be properly diminiſhed,* —— —— 44
5. *To find the* Length *of any Repreſentation by* Calculation *only,* 45
6. *To find the* Diſtance *of any* Picture *by means of the vaniſhing Points of a Square,* —— —— —— ib.
7. *To find the* vaniſhing Lines *and* vaniſhing Points *of* inclined Planes, *together with their* Centers *and* Diſtances, —— ib.
[*See alſo* p. 32
8. *General Rules for all Kinds of* vaniſhing Lines, —— 46
9. *A Method taken from* Marolois, *uſeful in ſome Caſes,* —— 47

SECT. II.

The foregoing Rules more particularly applied to common Practice.

1. *In putting a* Tuſcan Pedeſtal *into Perſpective,* —— 48
2. ------Circular Mouldings, *viz. the* Tuſcan Baſe *and* Capital, *and the* Corinthian Capital, —— —— —— 51
3. ------ Columns *in general,* —— —— —— 53
4. ------ Stairs *in general,* —— —— —— 55
5. ------ *An* Arch *and* Pediment, —— —— 56
6. ------ Houſes *in general,* —— —— —— ib.
7. ------ *The* inſide *of a* Room, —— —— —— 57

CHAP. IV.

Horizontal Perſpective.

1. *To draw a* Deception *upon a* Cieling, *which ſhall appear like the Sides of a Room continued upwards,* —— —— 60
2. *To put two* Cylinders *into Perſpective,* —— —— ib.
3. *Of* Pilaſters, —— —— —— —— 61
4. *Of* oblique Objects, —— —— —— ib.
5. *Of* Arches, —— —— —— —— ib.
6. *Of* Windows, —— —— —— —— 62
7. *Of* Mouldings, —— —— —— —— ib.

8, 9, *Of*

8, 9. *Of* Baſes *and* Capitals, —— —— Page 62
10. *Of the* Human Figure, —— —— —— 63
11. *Of the Repreſentation of* Domes *upon* flat Cielings, *&c.* — 65

CHAP. V.

The Perſpective of Shadows.

SECT. I.

Of SHADOWS *projected by the* SUN. —— 66
1. *When the* Light *comes in Planes* parallel *to the Picture,* 67
2. *When the* Light *comes from* behind *the Picture,* —— 68
3. *When the* Light *comes from* before *the Picture,* —— ib.

From whence are deduced the following general Examples, viz.

To find the Shadow *of a* perpendicular Object, *when it is caſt upon the* Ground *only,* —— —— —— 69
To find the Shadow *of an* oblique Object, *when it is caſt upon the* Ground *only,* —— —— —— ib.
To find the Shadow *of a* perpendicular Object, *when it is caſt upon an* inclined Plane, —— —— —— 70
To find the Shadow *of an* inclined Object *upon a* perpendicular Plane, —— —— —— —— ib.
To find the Shadows *of* perpendicular Objects, *when they are caſt upon Planes that are every Way* oblique *with the Picture,* — ib. 71
Of Shadows projected *by the* Candle, *&c.* —— —— ib.

SECT. II.

Some Conſiderations upon the Degree *and* Colour *of* Shadows, *&c. and of* Reflections *in* Water, —— —— 72
1. *Of the* Colours *and* Degrees *of* Shadows, —— —— ib.
2. *Of* Reflections *in* Water, —— —— —— 74

CHAP. VI.

Of SCENOGRAPHY; *or* SCENE-PAINTING, —— 76

CHAP. VII.

Several Methods of Perſpective, by the moſt eminent Authors.

1. Vignola's *Method*, ——— ——— ——— Page 82
2. Marolois's *Method*, ——— ——— ——— ib.
3. Vredeman Frieſe's *Method*, ——— ——— ——— 83
4. *The* Jeſuit's *Method*, ——— ——— ——— ib.
5. Andrea Pozzo's *Methods*, ——— ——— ——— ib.

A Com-

A
Compleat SYSTEM of PERSPECTIVE.

BOOK I. CHAP. I.

Of Inſtruments uſed in Drawing, Geometrical Definitions and Propoſitions, and Practical Geometry.

SECT. I.

Of INSTRUMENTS *uſed in* DRAWING.

THE Inſtruments neceſſary in Drawing are as follows, *viz.*

1. A Tee-Square. Fig. 1.
2. A Parallel Ruler. Fig. 2.
3. A Drawing-Board; which is a ſmooth Board made exactly ſquare.
4. A Sector. Fig. 3.
5. A Semi-Circle, or Protractor. Fig. 4. This Inſtrument is half a Circle, divided into 180 equal Parts, which are called Degrees.

Theſe are all the neceſſary Inſtruments in Drawing, and may be had at any Mathematical-Inſtrument-Maker's.

In regard to their different Uſes: They are almoſt univerſal; but I ſhall only conſider them as applied to particular Purpoſes; and firſt, of the TEE-SQUARE and DRAWING-BOARD.

1. Let it be required to draw one Line CD, perpendicular to another Line AB. Fig. 5.

After having fix'd a Piece of Paper upon the Drawing-Board, apply the ſquare Arm ED of the Tee-Square to the Side of the Board, and draw the Line AB; then lay it in the ſame Manner againſt the Top or Bottom of the Board, and draw a Line touching the other Line in the given Point. Thus, let D be the given

Point; then draw CD, and the Line CD will be perpendicular to the Line AB.—And if an oblique Line AC is wanted; lay the Arm AB of the Square, which turns upon a Screw C, againſt the Edge of the Board, and move the Ruler backwards and forwards, 'till you have got it to the Inclination you want.

Fig. 2. 2. The PARALLEL RULER is to be uſed when we would work upon a looſe Paper, without uſing a Drawing-Board: Thus, let it be required to draw one Line CD, Fig. 8, parallel to a given Line AB; and let C, or D, be the Diſtance it is to be from AB: Lay the Edge AB of the Ruler, to the given Line AB, and keep the Limb ab fixed; then move the other Limb cd to the Diſtance propoſed, and draw a Line, as CD, which will be parallel to AB. So that having given only one Line, and erected a Perpendicular thereon, we may draw any Number of parallel Lines, or Perpendiculars to them; only obſerving to ſet off the exact Diſtance of every Line by a Prick of the Compaſſes, like C or D.

Fig. 3. 3. The SECTOR is made of two braſs Rulers, AB, AC, artificially fixed upon a Center A: This Inſtrument is uſually filled with a great Number of different Scales, which, tho' very uſeful in many Parts of the Mathematicks, are nevertheleſs foreign to our Purpoſe; and therefore, I ſhall conſider it only as having what is called a Line of Lines on one Side, and a Line of Polygons on the other; which different Scales are expreſſed upon the Sector, by the Letters LL and PP, as in the Figure; LL ſtands for the Line of Lines, and PP for that of Polygons. The Line of Lines ſerves as an univerſal Scale for dividing any Line into equal Parts, or into any given Proportion; for inſtance, I would Fig 24. divide the Line AB into ſix equal Parts: Take the Length of the Line in your Compaſſes, and ſet one Leg of them in the Point 6, upon the Line of Lines; then open the Sector 'till the other Leg of the Compaſſes coincides with the Point 6, which is on the Line of Lines upon the other Limb of the Inſtrument; in this Poſition keep the Sector fixed, 'till you have taken the Diſtance from 1 to 1; which Diſtance will be one ſixth Part of the Line given. And in the ſame Manner, a Line may be divided into any Number of equal Parts, even though they ſhould exceed the Numbers upon the Sector; ſuppoſe, for inſtance, it was required to divide a Line into 24 equal Parts; then ſet the Length of the Line from 12 to 12 and divide the 1-12th Part into two Parts, which will anſwer the Purpoſe.

The Line of Polygons is called ſo from its Uſe; which is, to divide a Circle into any Number of Parts, as in Fig. 27. which Figures are called by the general Name of Polygons; and the Method of uſing this Scale is extremely eaſy. For having firſt deſcribed a Circle, take the Radius (that is half its Diameter) and ſet it upon theſe Lines from 6 to 6; in this Poſition keep the Sector fixed, and you will have a Scale for dividing any Circle of that Radius into any Number of equal Parts; for if you want a ſeven-ſided Figure, (or Heptagon) take the Diſtance from 7 to 7; if an eight-ſided Figure, (or Octagon) take the Diſtance from 8 to 8, and ſo on.

Fig. 4. 4. The laſt Inſtrument is the SEMI-CIRCLE or PROTRACTOR, which is uſed in drawing all kinds of given Angles, and in the following Manner.

Fig. 7. Let it be required to make a right Angle* CAB, from the Point A, upon the given right Line AB.——Lay the lower Side BC of the Inſtrument, exactly even with the Line AB, and in ſuch a manner, that the Point, or Center A, will coincide exactly with the Point A upon the Line AB; then make a prick at 90, and draw AC, and the thing propoſed is done.——And after the ſame Manner any other given Angle may be drawn, which a little Experience will make much more eaſy than Words can do.

SECT. II.

GEOMETRICAL DEFINITIONS *and* PROPOSITIONS, *principally from* Simpſon's *and* Pardie's Geometry.

Fig. 5. 1. AN Angle is the Inclination of two right, or ſtraight Lines, AD, DC, meeting each other in a Point, as D; and the middle Letter D always denotes the Angle.

2. When one right Line CD, falling upon another AB, makes the Angles on both Sides equal, thoſe Angles are called right Angles, and the Line CD is ſaid to be perpendicular to AB; and if any Line AC be drawn from a Point A in one Line, to any Point C in the other, the Line ſo drawn is called the Hypothenuſe.

3. An acute Angle BDE, is leſs than a right Angle BDC.

4. An obtuſe Angle ADE is that which is greater than a right Angle ADC.

Fig. 8. 5. Parallel Lines are ſuch as are equally diſtant from each other, as AB, CD.

---

* For right Angles, ſee Geometrical Definitions in the next Section.

6. A plane Figure is that which lies evenly between its Bounds or Extremes; thus any ſmooth Surface is a plane Surface, and is therefore called a Plane.

Fig. 9, 10. 7. All plane Figures bounded by three right Lines AB, AC, BC, are called Triangles.

Fig. 10. 8. An equilateral Triangle ABC, is that whoſe Bounds or Sides are all equal.

Fig. 11. 9. Every plane Figure ABCD, bounded by four right Lines, is called a Quadrilateral; and if its Sides and Angles are equal, it is called a Square.

10. Any quadrilateral Figure, whoſe oppoſite Sides are parallel, but not equal, is called a Parallelogram.

Fig. 12. 11. A right Line is ſaid to be perpendicular to a Plane when it ſtands on it at right Angles; thus the right Line EF, is perpendicular to the Plane ABCD, when it ſtands like a Pillar upon the Ground, and is inclined no more to any one Side of the Plane than to the other.

Fig. 13. 12. One Plane ABCD, is right and perpendicular to another EF, when, like a well-made Wall, it inclines and leans on one Side no more than it does on the other.

Fig. 9, 10. 13. Two right Lines, if they meet ſo as to cut or croſs each other, are in the ſame Plane; wherefore all the Angles, A, B, C, and Sides AB, BC, CA, of every Triangle, are in the ſame Plane.

Fig. 14. 14. If two Planes ABC, EFGH, cut or interſect one another, they ſhall do it in a right Line EF, which Line is called their Common Section.

15. If a right Line FG, be perpendicular to two right Lines FD, FE, which are in the ſame Plane ABC, that Line is alſo perpendicular to that Plane.

16. If a right Line FG be perpendicular to three right Lines, FI, FE, and FD; thoſe three Lines are all in the ſame Plane, ABC.

17. If two Lines FG, EH, are perpendicular to the ſame Plane ABC, they will be parallel to one another.

Fig. 15. 18. Two Lines EG, FH, perpendicular to the ſame Plane ABCD, cannot be drawn through the ſame Point G.

Fig. 16. 19. If two parallel Planes ABCD, EFGH, are cut by a third Plane IKLM, the common Sections, OP, QR, are parallel.

Fig. 17. 20. If the Lines GM and HN, are divided by parallel Planes, then GI will have the ſame Proportion to IM, as HL has to LN; and the Section MN, IK, of any plane Triangle MGN, by two parallel Planes, is always in a given Ratio; that is, IK is in the ſame Proportion to IG, as MN is to MG.

21. A ſolid Angle E, is made by the meeting of three or more Planes, and there joining in a Point; like the Point of a Diamond, or the Corner of a Die, or Cube. Fig. 18.

22. If we imagine a Line, as EB, fixt above in the Point E, to be moved along the Sides of any regular Figure, ABCD, that Line, by its Motion, will deſcribe a Figure that is called a Pyramid.

23. If a Line faſtned as before, move round a Circle, AB, it will deſcribe a Figure that is call'd a Cone; and the Circle is its Baſe, and a Line drawn from the Vertex C, to D, is called its Axis. Fig. 19.

24. If a Line AD, move uniformly about two angular Figures, ABC, DEF, which are every Way equal, having their Sides and Angles mutually parallel and correſponding exactly to one another, as DF to AB, DE to AC, *&c.* then that Line by its Motion ſhall deſcribe, if it hath three Sides, a Priſm; if four, a Cube or Parallelogram. Fig. 20.

25. If a Line move uniformly round two equal and parallel Circles, it ſhall deſcribe or generate a Cylinder; and the Line joining the Centers AB, in the two Baſes, is called its Axis. Fig. 21.

26. If any ſolid Body is laid with one Face upon another Plane, the Space which that Face takes up is called its Seat; thus the Cube CG, reſts with its Face CDEH, upon the Plane IK; therefore, CDEH is the Seat of the Cube on that Plane; and thus the Points C and D, are the Seats of the Lines CA, BD; as are alſo CD, CE, the Seats of the Lines AB and AF; and ſo likewiſe, the Seat of the oblique Line FC, is the Line EG. Fig. 22.

SECT. III.

Of PRACTICAL GEOMETRY.

To erect a Perpendicular CD, *upon* D, *the Middle of a right Line* AB.

FROM D, ſet off on the Line AB, any Diſtances DA, DB, equal to each other; then from A, deſcribe at Pleaſure the Arc cd, and with the ſame Diſtance from B, deſcribe the Arc ab; and then from the Point C, where they cut each other, draw DC; ſo will DC be perpendicular to AB. Fig. 5.

To let fall a Perpendicular CD *upon a Line* AB, *from a Point* C, *without the Line.*

From the given Point C, deſcribe the Arc AEB at pleaſure, and from the Points A and B, deſcribe two other Arcs cutting each other in F; draw CF, then are CD and FD perpendicular to AB. Fig. 6.

To

To erect a Perpendicular AC, *upon the Extremity* A, *of a Line* AB.

Fig. 7. With any Diſtance, deſcribe the Arc efg from the given Point A, and ſet off the ſame Diſtance upon the Arc from e to f, and from f to g; then from the Points g, f, deſcribe the Arcs ab, cd; and from their Section C, draw AB, which will be perpendicular to AB.

To draw one Line CD, *from a given Point* D, *parallel to a given Line* AB.

Fig. 8. Draw, as you think proper, the oblique Line AD from the given Point D, cutting AB in A; and from the Point A, with any Diſtance AB, deſcribe the Arc DB, cutting AD in D; then from D, with the Diſtance AD, deſcribe the Arc AC; and make AC equal to BD; and then draw the Line CD, which is parallel to AB.

Or it may be done yet eaſier, by deſcribing two Arcs CD, with the ſame Radius as in the other Figure, and drawing CD to touch them both.

To make any Triangle, as ABC, *from three given Lines,* AF, BE, CD.

Fig. 9. Draw a Line AB at Pleaſure, and make AB equal to the given Line AF; then from the Point B, with the Radius BE, deſcribe an Arc cd; with the Radius CD, from the Point A, deſcribe another Arc AB, cutting the former Arc in C; then from C draw Lines to A and B; and then will ABC be a Triangle whoſe Sides are reſpectively equal to the given Lines AF, BE, and CD.

To make an equilateral Triangle upon a Line given, AB.

Fig. 10. Take the Length of AB in your Compaſſes, and from the Points A and B, deſcribe two Arcs cutting each other in C; then from C, draw CA, CB; and then is ABC an equilateral Triangle whoſe Sides are all equal.

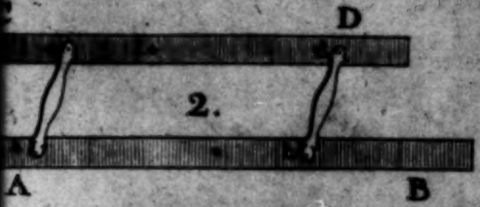
To make a Geometrical Square ABCD, *on the given Line* AB.

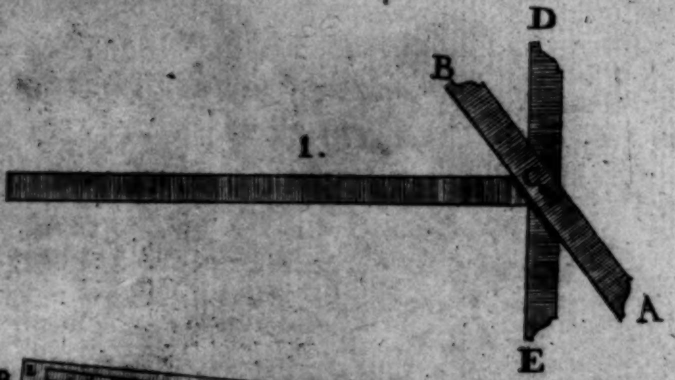
Fig. 11. From the Point B erect the Perpendicular BC; from B, with the Radius AB, deſcribe the Arc AC, cutting the ſaid Perpendicular in C; from A and C, (with the ſame Radius) deſcribe two more Arcs cutting each other in D; then draw DA, DC, and the Figure propoſed is compleated.

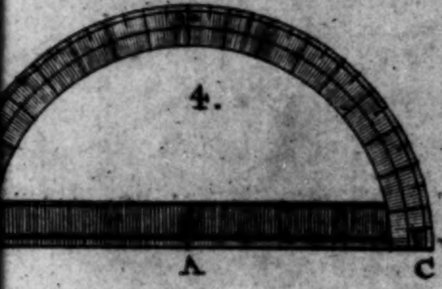
To make an Angle, with the Line AB, *equal to a given Angle* X.

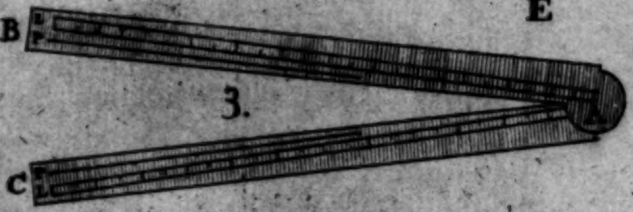
Fig. 23. From the Point A, with any Radius, deſcribe the Arc cd; from D, with the ſame Radius, deſcribe the Arc ab; take the Length of

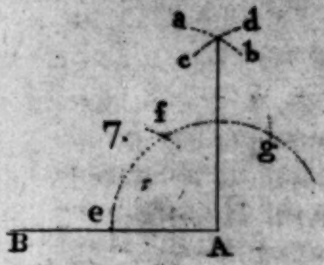
1.

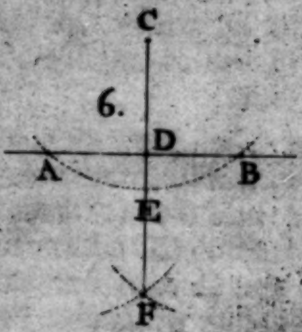

C
D
2.
A
B

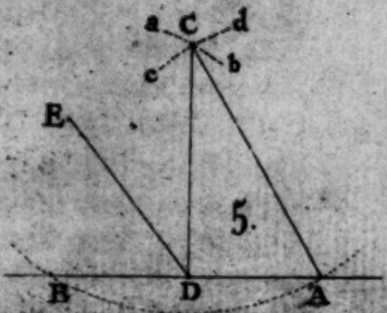

D
B
1.
A
E

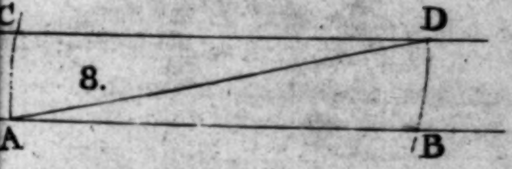

4.
A
C

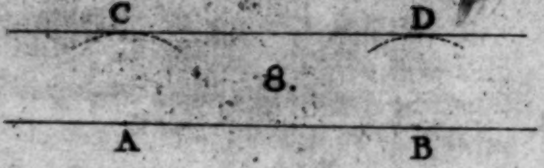

B
3.
C
A

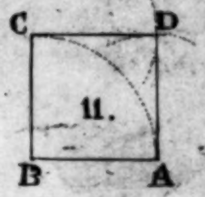

a
d
e
b
f
7.
g
e
B
A

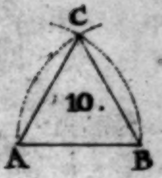

C
6.
D
A
B
E
F

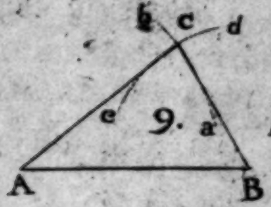

a
C
d
e
b
E
5.
B
D
A

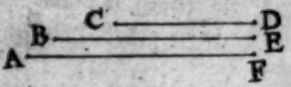

C
D
8.
A
B


C
D
8.
A
B


C
D
11.
B
A

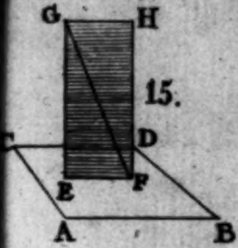

C
10.
A
B

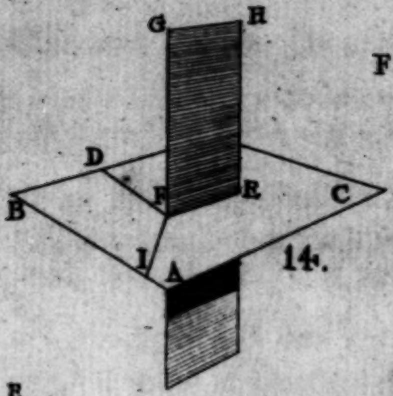

b
c
d
e
9.
a
A
B

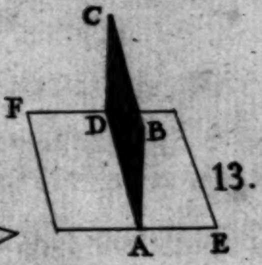

C
D
B
E
A
F

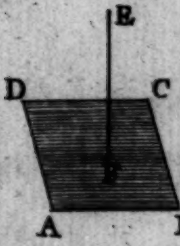
BRITISH
1 JY64
MUSEUM

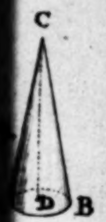
I.

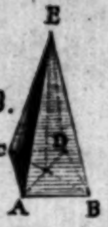

15.

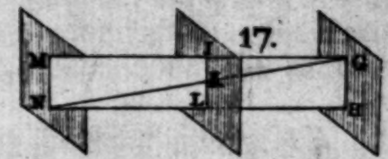

14.

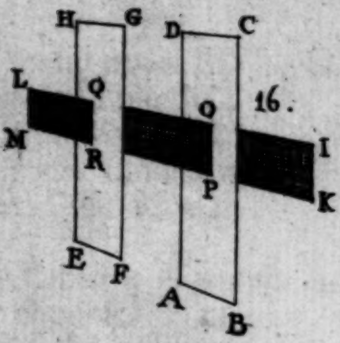

13.

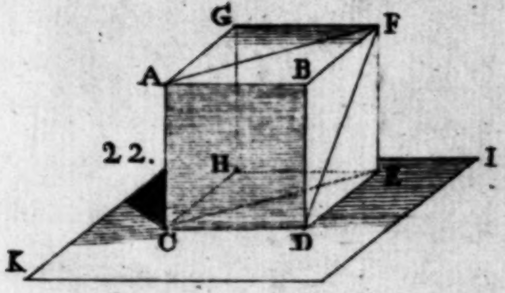

12.

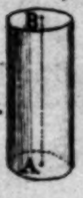


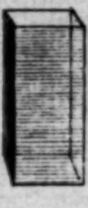

18.

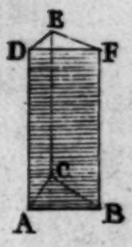

17.

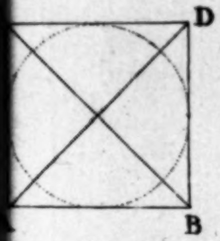

16.

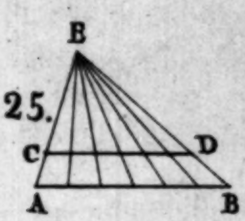

22.

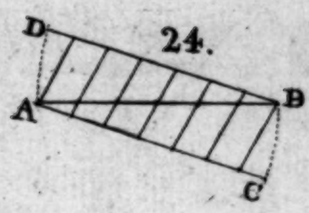

21.

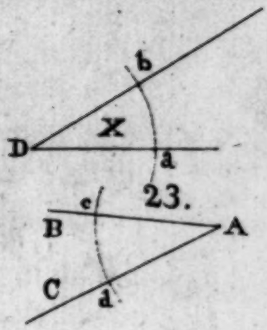


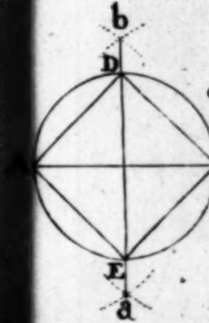

20.

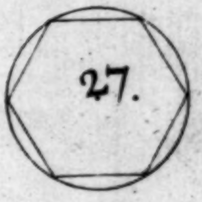

26.

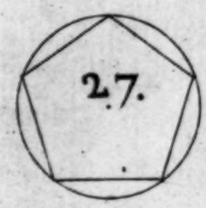

25.

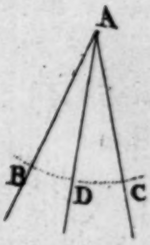

24.


23.


26.2.






23.2

BRITISH
1 JY64
MUSEUM

of ab, and transfer it from c to d, and through d draw a Line to A; then is the Angle BAC equal to the given Angle aDb.

To biſect, or divide an Angle A *into two equal Parts.*

From the Point A, with any Radius, deſcribe the Arc BC; divide BC into two equal Parts, and draw AD. Fig. 23. No. 2.

To divide a right Line AB *into any Number of equal Parts.*

From the Point A draw at pleaſure the Line AC, and make BD parallel thereto; then carry as many Parts along the Line AC, from the Point A, and along the Line BD, from B, as you would divide the Line AB into (for inſtance, ſix Parts) and draw the tranſverſe Lines, which will divide the propoſed Line as was required. Fig. 24.

Or, it may be done by drawing a Line AB, parallel to a given Line CD; then by ſetting as many equal Parts upon the Line AB as CD ſhould be divided into, and by drawing Lines from thence to a Point, as E, from every Diviſion, and in ſuch a Manner, that the outward Lines AE, BE, ſhall touch the Ends of the Line CD, as in the Figure. I ſay then, the Line CD will be divided into that Equality of Parts which was required. Fig. 25.

To inſcribe a Circle within a Square ABCD.

Draw the Diagonals AC, BD, and where they croſs each other will be the Center of the Square, which conſequently is the Center of the Circle alſo. Fig. 26.

To inſcribe a Square in a given Circle.

Draw the Diameter AB, from A and B deſcribe the Arcs a, b, and draw DE; from A, D, B, E, draw Lines as in the Figure, which will be the Square required. Fig. 26. No. 2.

As to the Geometrical Conſtruction of Polygons, I ſhall not take up the Reader's Time about them; for they may be deſcribed very eaſily by Means of the Scale upon the Sector for that Purpoſe, as has been obſerved before, under the Word SECTOR. Fig. 27.

CHAP.

CHAP. II.

Of the Eye and the Nature of Viſion, the Reflection and Refraction of the Rays of Light, and the Cauſe of Colours.

SECT. I.

Of the EYE *and the* NATURE *of* VISION.

THE Deſign of this Chapter is, to explain to the unlearned Reader the Conſtruction of the Human Eye, and to give him a general Idea of the Nature and Cauſe of Viſion; and not to proceed in a regular Manner upon Opticks, but only to take Notice of ſome particular Parts of it, by which he will be enabled to ſee more clearly the Nature of Perſpective. In order to which, I ſhall take Quotations from the moſt eminent Writers upon that Subject, and not preſume to give him much of my own, as nothing which I can offer will be new, or ſo much to the Purpoſe.

“ Every viſible Body emits or reflects inconceivably ſmall Particles
“ of Matter from each Point of its Surface, which iſſue from
“ it continually (not unlike Sparks from a Coal) in ſtrait Lines
“ and in all Directions. Theſe Particles entering the Eye, and
“ ſtriking upon the Retina (a Nerve expanded on the back Part of
“ the Eye to receive their Impulſes) excite in our Minds the Idea
“ of Light, and as they differ in Magnitude, they produce in us
“ the Ideas of different Colours.

“ That the Particles which conſtitute Light, are exceedingly
“ ſmall, appears from hence, *viz.* that if a Hole be made through
“ a Piece of Paper with a Needle, all the Rays of Light which
“ proceed at the ſame Time from all the Objects on one Side of it,
“ are capable of paſſing through it at once without the leaſt Confuſion;
“ for any one of thoſe Objects may as clearly be ſeen
“ through it, as if no Rays paſſed through it from any of the
“ reſt. Further, if a Candle is lighted, and there be no Obſtacle
“ in the Way to obſtruct the Progreſs of its Rays, it will fill all
“ the Space within two Miles of it every Way with luminous
“ Particles, before it has loſt the leaſt ſenſible Part of its Subſtance
“ thereby.

" That theſe Particles proceed from every Point of the Surface of a viſible Body, and in all Directions, is clear from hence, *viz.* becauſe where-ever a Spectator is placed with regard to the Body, every Point of that Part of the Surface which is turned towards him, is viſible to him. That they proceed from the Body in right Lines, we are aſſured, becauſe juſt ſo many and no more will be intercepted in their Paſſage to any Place, by an interpoſed Object, as that Object ought to intercept, ſuppoſing them to come in ſuch Lines. The Velocity (or Swiftneſs) with which they proceed from the Surface of the viſible Body, is no leſs ſurpriſing than their Minuteneſs: For by the Calculation of the moſt accurate Philoſophers, they are no more than about ſeven Minutes in paſſing over a Space equal to the Diſtance between the Sun and us, which is about eighty-one Millions of Miles, and is conſiderably more than a Million Times greater than the Velocity of a Cannon Ball.

" A Stream of theſe Particles iſſuing from the Surface of a viſible Body in one and the ſame Direction, is called a Ray of Light.

" As Rays proceed from a viſible Body in all Directions, they neceſſarily become thinner and thinner, continually ſpreading themſelves as they paſs along, into a larger Space, and that in proportion to the Squares of their Diſtances from the Body; that is, at the Diſtance of two Spaces, they are four Times thinner than they are at one; at the Diſtance of three Spaces, nine Times thinner, and ſo on: The reaſon of which is, becauſe they ſpread themſelves in a twofold Manner, *viz.* upwards and downwards, as well as ſide-ways."*—This may be the more clearly comprehended by the following Experiment.

Fig. 33.

" Let the Light which flows from a Point A, and paſſes through a ſquare Hole b c d e, be received upon a Plane, BCDE, parallel to the Plane of the Hole; or, if you pleaſe, let the Figure BD, be the Shadow of the Plane b d; and when the Diſtance AB is double of A b, the length and breadth of the Shadow BD will each be double the length and breadth of the Plane a b; and treble, when AB is treble of A b, and ſo on; which may be eaſily examined by the Light of a Candle placed at A.

" Therefore the Surface of the Shadow BD, at the Diſtance AB double of A b, is diviſible into four Squares, and at a treble

---

* Vide Rowning's Opt. Part 3, p. 4.

Diſtance into nine Squares, ſeverally equal to the Square b d, as repreſented in the Figure. The Light then which falls upon the Plane b d, being ſuffered to paſs to a double Diſtance, will be uniformly ſpread over four times the Space, and conſequently will be four times thinner in every Part of that Space, and at a treble Diſtance will be nine times thinner, and at a quadruple Diſtance ſixteen times thinner than it was at firſt; and ſo on according to the Increaſe of the ſquare Surfaces b c d e, BCDE, *&c.* or of the ſquare Surfaces A b f g, ABFG, *&c.* built upon the Diſtance A b, A B, *&c.* Conſequently the Quantities of this rarified Light, received upon a Surface of any given Size or Shape whatever, removed ſucceſſively to thoſe ſeveral Diſtances, will be but one quarter, one ninth, one ſixteenth, of the whole Quantity received by it at the firſt Diſtance A b. Or in general Words the Denſities or Quantities of Light, received upon any given Plane, are diminiſhed in the ſame Proportion as the Square of the Diſtances of that Plane, from the luminous Body are increaſed; and on the contrary, are increaſed in the ſame Proportion as thoſe Squares are diminiſhed. For the Lights of the ſeveral Points of the Body, which ſeverally follow this Rule, will compoſe a Light which will ſtill follow the ſame Rule." *

Having thus far explained what we are to underſtand by the Rays of Light, we will now proceed to a Deſcription of the Human Eye, and conſider the Nature of Viſion.

Fig. 28. "ATYC is the Repreſentation of an Human Eye, diſſected through its Axis †, all the Parts being twice as big as the Life.

"Here the tranſparent Coats, called the Cornea, is ABC; the Remainder ATYC being opake, and a Portion of a larger Sphere. Within this outward Coat Anatomiſts diſtinguiſh two others; the innermoſt of which is called the Retina, being like a fine Net compoſed of the Fibres of the Optick Nerve YVT woven together, and is white about the Parts p, q, r, at the Bottom of the Eye. The Cavity of the Eye is not filled with one Liquor, but with three different Sorts. That contained in the outward Space ABCOEGFD is called the Aqueous Humour, being perfectly fluid, like Water; the other, contained

---

* Vide Smith's Opt. P. 17, Art. 57, 58.

† The Axis of the Eye is a Line drawn through the Middle of the Pupil and of the Cryſtalline Humour, and conſequently falls upon the Middle of the Retina. And the Axes of both Eyes produced, are called the Optick Axes; which will be better underſtood after the Deſcription of the Eye.

“ in the inward Space E p q r D F G is a little thicker than the White of an Egg, and is called the Vitreous Humour; the third Humour, F G, is ſhaped like a Lens * of unequal Convexities, lying between the two former, and fixed to the ſide Coats by Filaments or Threads extended all round it, and is called the Cryſtalline Humour, being hard like the White of an Egg boiled, but as clear as the other two, and differs from them in a greater Degree of Refractive † Power; whereby the Rays that came from the Points P, Q, R, having received a Degree of Convergence ‡ by the Refraction of the Cornea A B C, are made to converge a little more by other Refractions at the Surfaces of the Cryſtalline F G; ſo that uniting in as many Points p, q, r, upon the Retina, they repreſent the Points of the Object P, Q, R, from whence they came. ‖

The Picture of an Object upon the Retina being produced much in the ſame Manner as a Picture by a Lens, *viz.* in both Caſes by Means of the Refraction of the Rays of Light, we will therefore, firſt ſhew how by the Paſſage of thoſe Rays through a Lens, a Picture may be produced; as this will be one conſiderable Step towards explaining the Nature of Viſion: For which Purpoſe I ſhall quote an Experiment from the incomparable Sir *Iſaac Newton.* §

“ Let P R repreſent an Object without Doors, and A B a Lens placed at a Hole in the Window-Shutter of a dark Chamber, whereby the Rays that come from any Point Q of that Object, are made to converge and meet again in the Point q; and if a Sheet of white Paper be held at q, for the Light there to fall upon it, the Picture of that Object P R will appear upon the Paper in its proper Shape and Colours. For, as the Light which comes from the Point Q, goes to the Point q, ſo the Light which comes from other Points P and R of the Object, will go to ſo many other correſpondent Points p and r; ſo that every Point of the Object ſhall illuminate a correſpondent Point of the Picture, and thereby make a Picture like the Object Fig. 29.

---

* By a Lens in this Place is meant a Glaſs which collects the Rays of Light into a Point, like a common Burning-Glaſs.

† When a Ray of Light paſſes out of one Medium into another of a different Denſity, it will be bent near the Surfaces of thoſe Mediums, which bending is called Refraction.

‡ If ſeveral Rays approach each other ſo as to meet in a Point, they are ſaid to converge; and if they proceed from a Point and go further off continually, they are then ſaid to diverge.

‖ Vide Smith's Opt. p. 26.

§ Vide Newton's Opt. p. 11.

“ in Shape and Colour, this only excepted, that the Picture ſhall
“ be inverted. And this is the Reaſon of that vulgar Experiment
“ of caſting the Species of Objects from abroad upon a Wall, or
“ Sheet of white Paper in a dark Room.*

Fig. 28. “ In like Manner, when a Man views any Object PQR, the
“ Light which comes from the ſeveral Points of the Object is ſo
“ refracted by the tranſparent Skins and Humours of the Eye,
“ (that is, by the Cornea ABC, and by the Cryſtalline Humour
“ FG) as to converge and meet again in ſo many Points in the
“ Bottom of the Eye, and there to paint the Picture of the Object
“ upon the Retina. And theſe Pictures, propagated by Motion
“ along the Fibres of the Optick Nerves into the Brain, are
“ the Cauſe of Viſion. For accordingly as theſe Pictures are perfect
“ or imperfect, the Object is ſeen perfectly or imperfectly.
“ If the Eye be tinged with any Colour (as in the Diſeaſe of
“ the Jaundice) ſo as to tinge the Pictures in the Bottom of the
“ Eye with that Colour, then all Objects appear tinged with the
“ ſame Colour. If the Humours of the Eye by old Age decay,
“ ſo as by ſhrinking to make the Cornea and Coat of the Cryſtalline
“ Humour grow flatter than before, the Light will not be
“ refracted enough, and for want of a ſufficient Refraction will
“ not converge to the Bottom of the Eye, but to ſome Place beyond
“ it, and by Conſequence paint in the Bottom of the Eye a
“ confuſed Picture.---This is the Reaſon of the Decay of Sight in
“ old Men, and ſhews why their Sight is mended by Spectacles.
“ For theſe Convex Glaſſes (or Lenſes) ſupply the Defect of
“ Plumpneſs in the Eye, and by increaſing the Refraction makes
“ the Rays converge ſooner, ſo as to convene diſtinctly at the
“ Bottom of the Eye, if the Glaſs has a due Degree of Convexity.
“ And the Contrary happens in ſhort-ſighted Men, whoſe Eyes
“ are too plump. For the Refraction being now too great, the
“ Rays converge and convene in the Eyes before they come at the
“ Bottom; and therefore the Picture made in the Bottom, and the
“ Viſion cauſed thereby, will not be diſtinct, unleſs the Object be
“ brought ſo near the Eye as that the Place where the converging
“ Rays convene may be removed to the Bottom, or that the
“ Plumpneſs of the Eye be taken off, and the Refractions dimi-

---

* A Perſon may eaſily ſatisfy himſelf of the Truth of this, by only taking a common Burning-Glaſs in one Hand, and a Piece of white Paper in the other, and let him hold the Glaſs before any Object, and the Paper on the oppoſite Side of the Glaſs; then by moving the Glaſs or Paper backwards and forwards 'till he gets the Rays to their proper Focus, he will ſee the Picture of the Object upon the Paper, but it will not be ſo diſtinct as in the dark Chamber.

“ niſhed by a Concave-Glaſs of a due Degree of Concavity; or laſtly, that by Age the Eye grows flatter, 'till it comes to a due Figure: For ſhort-ſighted Men ſee remote Objects beſt in Old Age; and therefore they are accounted to have the moſt laſting Eyes.” *

“ As to the Diſtinctneſs of Viſion in a perfect Eye, that evidently depends upon the Refraction of the Rays; and it is then as diſtinct as poſſible, when the Refraction is ſo made, as that all the Rays which come from one and the ſame Point of the Object, meet together exactly in one and the ſame Point of the Bottom of the Eye: But this is never preciſely ſo, but in thoſe Rays which come from that Point of the Object which is at the Extremity of the optick Axis Q q; for it is evident, that thoſe Rays which come from the other Points, are reunited ſo much the leſs exactly one than the other, as they are more diſtant from this Axis; wherefore we cannot have at the ſame time, the moſt diſtinct Senſation but in this Place alone, and the reſt will be more confuſed.” †

Fig. 28.

Fig. 30.

The farther diſtant the Eye is from an Object, ſo much leſs will the Picture of that Object be upon the Retina: For let E be an Eye viewing the ſeveral Objects AB, CD, EF, at the Diſtance OQ, OR, OS.—Having drawn the ſeveral Rays Aa, Ab, Cc, Dd, Ee, Ff, through the Pupil O, it will be manifeſt, that the Picture of the neareſt Object AB, will be painted at the Bottom of the Eye in the Space ab, the Object CD in the Space cd, and the fartheſt Object, EF, in the Space ef; therefore, as the Space ab, is larger than the other two cd, or ef, the Picture of AB will be larger than the Picture of the other two Objects CD or EF, which are at a greater Diſtance from the Eye; and theſe Pictures will be to each other, as the ſeveral Diſtances OQ, OR, OS, are to each other. ‡ From hence then we may eaſily conceive, that *the Eye* may be ſo far removed from *the Object*, that at laſt the Image of that Object will totally diſappear.‖

“ But the Degree of Brightneſs of the Picture of an Object painted upon the Retina continues the ſame, at all Diſtances between the Eye and the Object, provided none of the Rays be

---

* Vide Newton's Opt. p. 12.
† Vide Clarke's Rohault, vol. I. p. 249.
‡ Ibid, ———————— p. 243.
‖ The Rays of Light OA and OB, which come from the extreme Points of the Object to the Eye O, form an Angle AOB, which is called the Optick or viſual Angle; and the Rays OA and OB are called viſual Rays.

" ſtopt by the Way, and that the Pupil does not alter its Aperture. " For inſtance, when the Eye approaches as near again to the " Object, the Picture upon the Retina becomes double in Length " and double in Breadth, and conſequently quadruple in Surface; " for the Surface would be double, if its Length alone or Breadth " alone was double. The Quantity of Rays received through the " ſame Aperture of the Pupil, at half the Diſtance from the Object " is alſo quadruple, and being equally ſpread over four times the " Quantity of Surface of the Retina, they are juſt as denſe as before, when the Object was at twice that Diſtance.

" It follows then that the faint Appearance of remote Objects, " is owing to the Opacity of the Atmoſphere, which hinders Part of " their Light from coming to the Eye. Accordingly we find that " the Sun, Moon, and Stars appear very faint when near the Horizon, and brighter continually as they riſe higher; becauſe the " Tract of Vapours which lies in the way of the Rays; is longeſt " and thickeſt near the Horizon; and becomes thinner and ſhorter " as the Objects riſe higher, and conſequently does leſs obſtruct the " Paſſage of the Rays *.

Fig. 31. " Parallel Lines ſeen obliquely, as ABC, DEF, appear to converge more and more as they are farther extended from the Eye. " Becauſe the apparent Magnitudes † of their perpendicular Intervals AD, BE, CF, *&c.* are perpetually diminiſhed. And for " the ſame Reaſon they appear to converge towards an imaginary " Line, OG, drawn from the Eye parallel to them.

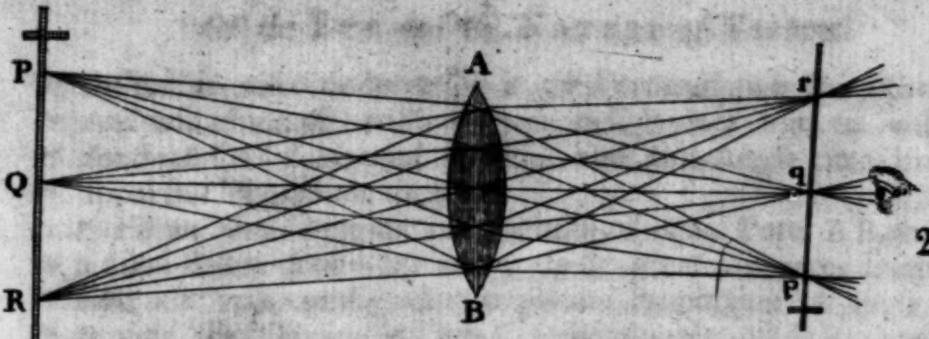
" This is the reaſon that the remoter Parts of a Walk or Floor " appear to aſcend gradually, and the Ceiling to deſcend towards " the Horizontal Line OG: And that the Surface of the Sea, ſeen " from an Eminence, appears to aſcend gradually in going from " the Shore; and that the upper Parts of very high Buildings ſeem " to lean forward over the Eye below, becauſe they ſeem to approach towards a vertical Line OG.

Fig. 32. " The apparent Magnitude of a given Line, AB, ſeen very obliquely at a given Diſtance, OA, increaſes and decreaſes in proportion to the Increaſe and Decreaſe of OP, the perpendicular " Diſtance of the Eye, from the Line AB produced; provided " the Line AO be very large in compariſon to AB. For let the " Ray BO cut a Line AC perpendicular to AB in C; and while

---

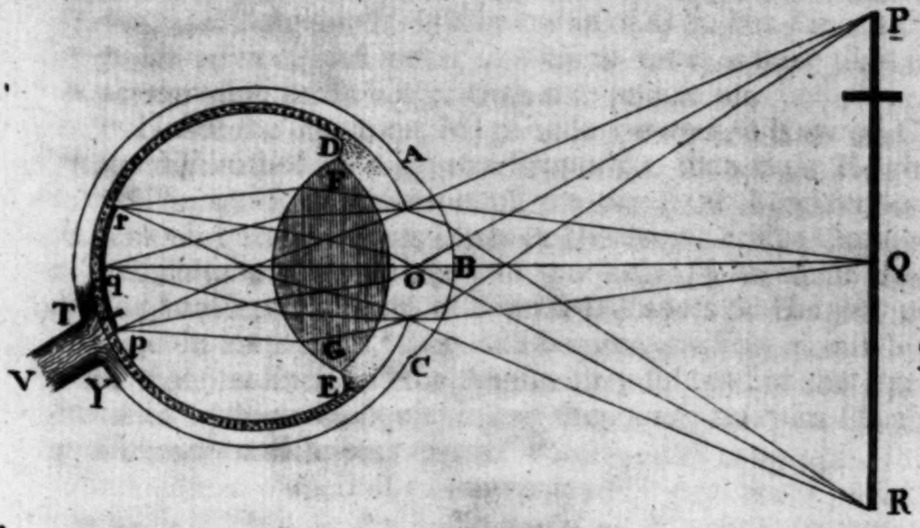
[*] Vide Smith's Opt. p. 29.

[†] By apparent Magnitude is here meant the Bigneſs of the Picture upon the Retina.



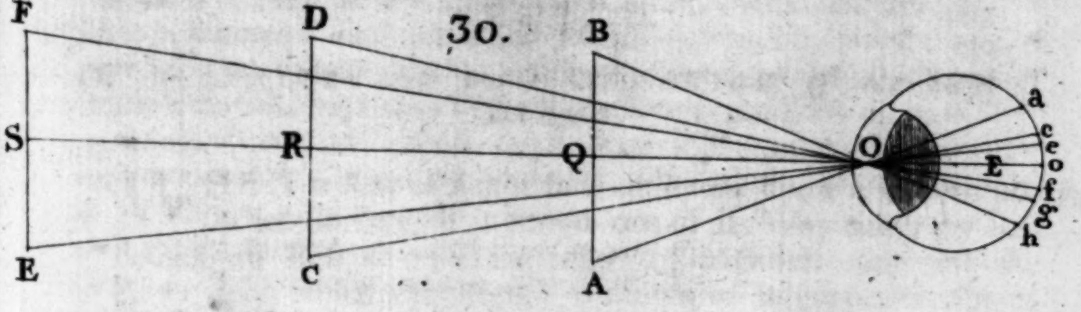
P
Q
R
A
B
r
q
p

29.



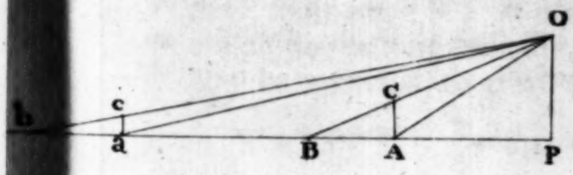
P
D
A
F
r
B
o
Q
q
T
p
G
C
V
Y
E
R

28.



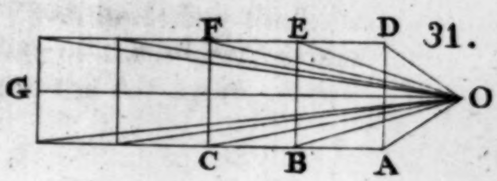
30.

F
D
B
S
R
Q
O
a
c
e
E
o
f
g
h
E
C
A



O
c
c
b
a
B
A
P

32.



31.

F
E
D
G
O
C
B
A

BRITISH
1 JY64
MUSEUM

“ the Eye is raiſed or depreſſed in the Perpendicular O P, the Line A C will increaſe and decreaſe as O P does, and ſo will the Angle A O C ſubtended by A C, and this Angle meaſures the apparent Magnitude of A B.

“ Hence the apparent Magnitudes of equal Parts A B, a b, of a Line P A b, ſeen very obliquely at great Diſtances from the Eye, are reciprocally in a duplicate Proportion of thoſe Diſtances. For Example, let O b be double of O B, and the Angle O B P will be double of O b P, and accordingly ſince AB, a b, are equal, the perpendicular A C will be double of a c, and being ſeen twice as near as a c, will appear four times bigger than a c. Again, if O b be treble of O B, the Line A C will be treble of a c, and being ſeen three times nearer than a c, will appear nine times bigger than a c; and ſo on.

“ Hence the apparent Magnitude between a Row of Columns are diminiſhed in a greater Proportion than their Heights.

“ The quick Diminution of the apparent Magnitudes of the remoter Parts of long Lines or Diſtances, is the Cauſe of great Difficulty and Uncertainty in our Eſtimate of their Quantities. For be the Differences of ſeveral Diſtances or Heights never ſo great in themſelves, they will become inviſible at laſt by reaſon of the Smallneſs of the Angles they ſubtend at the Eye, occaſioned by their Obliquity; and then thoſe unequal Heights and Diſtances will appear equal.” *

SECT. II.

Of the REFLECTION and REFRACTION of the Rays of LIGHT.

Fig. 34.

“ WHEN a Ray of Light falls obliquely upon a ſmooth poliſhed Surface, it is turn'd out of its Way either by Reflection or Refraction in the following Manner. Imagine the Paper upon which this Figure is drawn to be perpendicular to the Surface of ſtagnating Water, and to cut it in the Line R S, and that a Ray of Light, coming in the Air along the Line A C, falls upon R S at the Point C. Then ſuppoſing the Line P C Q to be perpendicular to the Surface of the Water, if the Ray be reflected, or turn'd back at C into the Air again, it will

---

* Vide Smith's Opt. p. 58.

“ deſcribe a ſtraight Line CB, inclin'd to the perpendicular CP
“ at an Angle PCB exactly equal to the Angle PCA, and there-
“ fore the Angle of Reflection is always equal to the Angle of
“ Incidence.

Fig. 35. “ But if the Ray that came along AC goes into the Water at
“ C, it will not proceed ſtrait forward, but being refracted or
“ bent at C, it will deſcribe another ſtrait Line CE, inclined to
“ the Perpendicular CQ, at a leſſer Angle, ECQ, than the
“ Angle ACP; and the Line CE will always be ſo ſituated,
“ that when any Circle, deſcribed about the Center C, cuts the
“ Line CA in A, and CE in E, the Perpendiculars AD, and
“ EF, drawn from A and E to the Line PQ, ſhall always bear
“ the ſame Proportion to each other, whatever be the Magnitude
“ of the Angle ACP. In Water the Line EF is always three-
“ quarters of AD.

“ In both theſe Caſes the Line AC is called the incident Ray,
“ CB the reflected Ray, CE the refracted Ray, C the Point of
“ Incidence, PCQ the Perpendicular (at the Point) of Incidence,
“ the Angle ACP the Angle of Incidence, BCP the Angle of
“ Reflection, ECQ the Angle of Refraction; the Line AD the
“ Sine of Incidence, that is, of the Angle of Incidence; and
“ EF the Sine of Refraction, that is, of the Angle of Refraction.

“ As Rays of Light are inceſſantly thrown out and dif-
“ perſed in all poſſible Directions from every Point of a luminous
“ Body; ſo when they illuminate other Bodies, on which they
“ fall, they are alſo inceſſantly thrown back from every Point of
“ thoſe Bodies. For the Points of opake Bodies ſo enlightened,
“ are viſible to the Eye at any Point of Space and in any Point of
“ Time, as well as the Points of the luminous Body that en-
“ lightened them. The numberleſs Rays which flow from all
“ viſible Bodies, called Objects, may be methodically diſtributed
“ in this Manner. The Surface of the Object is conſidered as
“ conſiſting of Phyſical Lines, and theſe Lines as conſiſting of
“ Phyſical Points, and theſe Points are conceived to radiate all
“ manner of Ways. It is uſual to make uſe of nothing elſe for
“ an Object but a Phyſical Line. For by how much that Line is
“ increaſed or diminiſhed in apparent Magnitude, or Brightneſs,
“ or Diſtinctneſs, ſo much the Diameter, or Length, of any Ob-
“ ject, in its Place, would be increaſed or diminiſhed.

Fig. 36. “ The Point Q, from which Rays diverge, or towards which
“ they converge (being made to go back towards the ſame Point,

“ though they may never meet at it) is called their Focus. And in both Caſes any Parcel of theſe Rays, as QBC, or QBA, conſidered apart from the reſt, is called a Pencil of Rays. This Figure repreſents the Manner in which the Rays of a Pencil, QAB, diverging from any Point of an Object Q, and falling upon a ſtrait Line ABC, or upon a poliſhed Plane repreſented by it, do all diverge after Reflection as if they came from another Point q. The Ray QC, which falls perpendicularly upon the Plane AB, is reflected back again along the ſame Line CQ; but all the reſt falling upon it with greater and greater Degrees of Obliquity, as the Points of Incidence lye farther and farther from C, are alſo reflected with Degrees of Obliquity reſpectively greater. It will ſeem reaſonable therefore, eſpecially by attending to the Figure, that the reflected Rays, produced backwards, ſhould meet the Perpendicular QC, produced in a Point q, ſituated as far from the reflecting Plane on one Side, as Q is on the other: And conſequently that all the Rays flowing from a ſingle Point Q, will after Reflection diverge from a ſingle Point q, at an equal Diſtance on the other Side of the reflecting Plane.

“ On the contrary, if q be a Focus to which the incident Rays are made to converge, the Point Q will be their Focus after Reflection from the Surface ACB.

“ What has been ſaid of the Point Q, is applicable to every other Point of an Object PQR; namely, that as the Focuſes Q, q lie at equal Diſtances on each Side of the reflecting Plane, ſo the Focuſes P, p lye on each Side at other equal Diſtances, and R, r at other equal Diſtances, in Lines Pp, Rr, drawn perpendicularly through the Plane AB. Hence it is eaſy to underſtand by Inſpection of the Figures, that theſe Focuſes p, q, r, with innumerable others, lying all in the ſame Order as the correſponding Points P, Q, R, compoſe an imaginary Line of the ſame Length and Shape as the Line PQR; and that the Situation of the Line pqr, with reſpect to the back ſide of the reflecting Plane, is the very ſame as that of PQR with reſpect to the fore ſide of it. This Line pqr is called an Image or Picture of the Object PQR.” * Fig. 37, 38, 39.

This may ſuffice to ſhew the Nature of the reflected Images of Objects from poliſh'd Planes; the Knowledge of which is abſolutely

---

* Vide Smith's Opt. p. 7.

lutely neceſſary in ſeveral Parts of Painting, eſpecially in Landſkips, where Water is often introduced; the Tranſparency of which, depends upon giving the Repreſentation of that Fluid its true or local Colour, and in giving the Reflections their proper Depths and Appearance.—Proceed we now to a farther Conſideration of the Refraction of the Rays of Light, as introductory to the Cauſe of Colours.

In the 35th Figure we obſerved, that if a Ray of Light went out of Air into Water, it would not proceed ſtrait forward, but be bent and turned out of its direct Courſe at the Point of Incidence C; and that the Reaſon of this Refraction, or bending of the Ray, was owing to its paſſing out of a rarer or thinner, into a denſer or thicker Medium; and in Proportion as this Medium into which the Light enters, is more or leſs denſe, the Ray will be more or leſs refracted. Now what is ſaid of one Ray, will hold equally true as to any Number of Rays: But ſince the Rays of Light are not alike, but diſſimilar, ſome greater and others leſs, they will be differently refracted at their Exit out of one Medium into another Medium; and being thus ſeparated, each Species of Rays will exhibit a Colour peculiar to itſelf; which is the Subject of the next Section.

SECT. III.

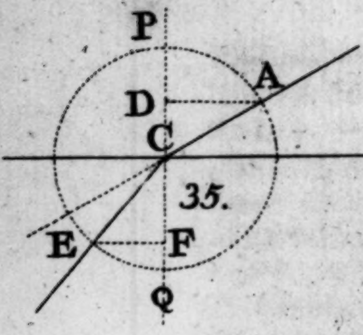
Of the Cause *of* Colours.

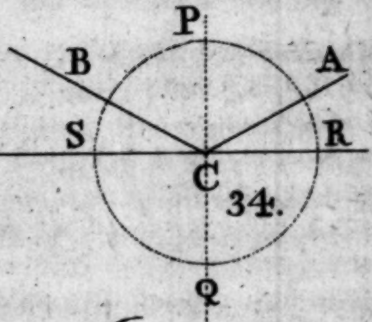
“ THE Sun's Rays are not homogeneous (that is alike) but of
“ different Kinds, and each Sort has a different Degree of
“ Refrangibility; that is, in paſſing through a denſe Medium they
“ are differently diſpoſed to be refracted, being bent or turn'd
“ out of their firſt Courſe to different Diſtances from the Perpendicular;
“ and theſe ſeveral Sorts of Rays have each a peculiar
“ Colour, *viz.* thoſe which are leaſt refrangible, are Red; the
“ ſecond Sort, Orange; the third Sort, Yellow; the fourth Sort,
“ Green; the fifth Sort, Blue; the ſixth Sort, Indigo; and the ſeventh
“ Sort, Violet, which laſt are moſt refrangible, or refracted
“ to the greateſt Diſtance from the Perpendicular.

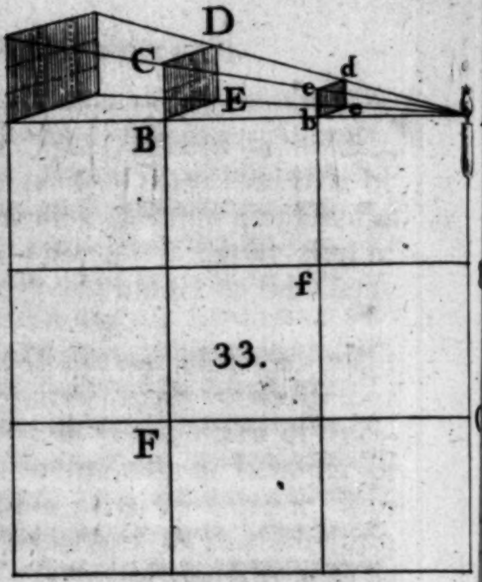
Fig. 40. “ To illuſtrate this Matter, let GF repreſent a Parcel of the
“ Solar Rays entering through the Hole H of a Window-Shutter,
“ into a darkened Room, and there let them fall on the Priſm
“ ABC, in the Point F: In paſſing through the Priſm they will be
“ ſeverally refracted in a different Degree, and thus ſeparated from

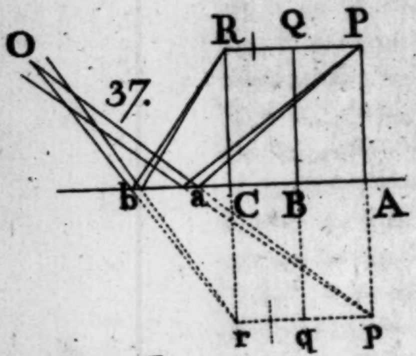
BRITISH 1 JY64 MUSEUM

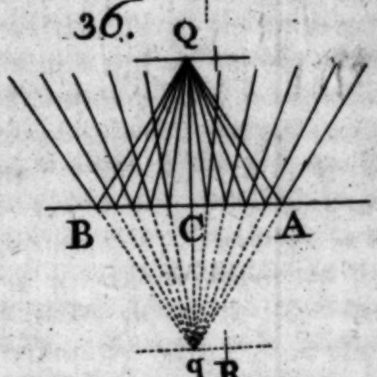
IV.

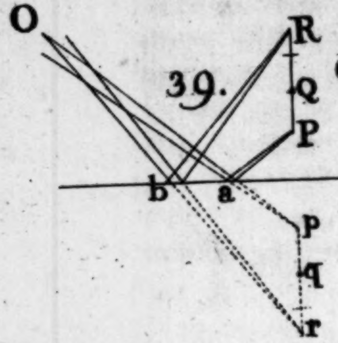

P
A
D
C
35.
E
F
Q

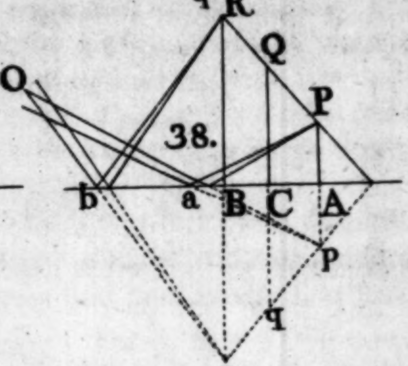

P
B
A
S
R
C
34.
Q

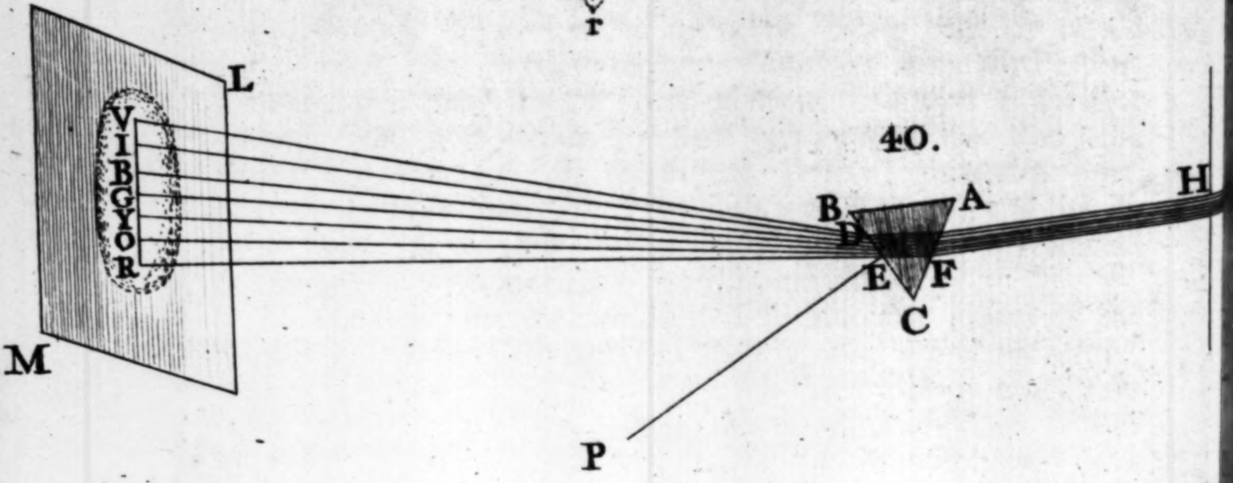

D
C
d
E
e
b
e
B
f
33.
F


O
R
Q
P
37.
b
a
C
B
A
r
q
p


36.
Q
B
C
A
q


O
R
39.
Q
P
b
a
p
q
r


R
Q
O
P
38.
b
a
B
C
A
p
q
r


L
40.
V
I
B
G
Y
O
R
H
B
A
D
E
F
C
M
P

“each other, ſo that at their Exit on the other Side at E, they will proceed at different Diſtances from the Perpendicular EP to the other Side of the Room, where they will make a long and various-coloured Image of the Sun XY; which is, perhaps, one of the moſt ſurprizing and agreeable Spectacles in Nature.

“The ſeveral Sorts of Rays, after they are refracted, appear in their own proper Colours, in Order as follows, *viz.* Thoſe which are leaſt refracted, or fall neareſt the Perpendicular EP, are Red, and make the red Part of the Spectrum at R; the next are the Orange at O, the Yellow at Y, the Green at G, the Blue at B, the Indigo at I, and the Violet at V: And theſe ſeven are all the original ſimple Colours in Nature; and of which, by various Mixtures, all others are compounded, in the common Refractions and Reflections from natural Bodies.[*]

“From hence then we may conceive, that Colour is a Senſation produced in the Mind, by the Impreſſion made in the Eye, by certain Kinds or Sorts of Rays of Light, ſeparated from others by means of their different Refrangibility and Reflexibility, whereby they are divided into ſeveral Parcels, each endowed with its own diſtinct Colour-making Power. And Bodies, whoſe Surfaces are diſpoſed to reflect one kind of theſe Rays more copiouſly than any others, exhibit, and are ſaid to be of that Colour which is peculiar to the Rays they moſt copiouſly reflect; and the infinite Diverſity of Bodies, and the different Mixtures and Modifications of different Colour-making Rays thereby occaſioned, muſt therefore produce that infinite Variety of Colours which beautifies the Face of Nature.”[†]

---

[*] The Truth of all this any Perſon may convince himſelf of by making the Experiment, or by only holding a Priſm between his Eyes and the Sun; then by turning it round, he will ſee the ſeveral Colours in their proper Order, as above deſcribed.

[†] Martin's Philoſ. vol. II. p. 156.——Hamilton's Perſp. p. 1.

CHAP. III.

The THEORY *of* PERSPECTIVE.

SECT. I.

An Explanatory Part, by Way of INTRODUCTION.

PERSPECTIVE is the Art of drawing upon any Surface the Repreſentation of Objects as they appear to the Eye: In order to which, it is neceſſary to ſuppoſe the Light ſhould come from every Part of the Repreſentation in the very ſame Manner, and with the very ſame Strength of Colour, as it would do from the real Objects themſelves, were they put in the Place of the Picture; becauſe then, the Eye will not be able to judge, whether what it ſees be a few Colours artificially laid upon a Canvas, or the real Objects themſelves in the ſame Situation.

This is a general Definition of that kind of Perſpective I am going to explain; which, is only what relates to the Arts of Painting and Deſigning; but not to any of the Mathematical Arts, which are too abſtruſe for my Speculations, and would be of no real Service to thoſe for whoſe Uſe this Work is chiefly intended: And although Perſpective Repreſentations may be drawn upon any Surfaces, be they ever ſo irregular, yet I ſhall firſt confine myſelf to ſmooth even Planes, ſuch as a Canvas, Wall, Cieling, or the like.---This being premiſed,

Fig. 41. Let E be the Eye, HE its Height from the Ground OP, and TOSX a ſquare Object laid flat upon the Ground. Now it is evident, from what was ſaid in the laſt Chapter, Sect. 1. that the Eye will ſee the Object TOSX, by means of the Rays of Light which come from every Part of the Object to the Eye. Let us therefore ſuppoſe a tranſparent Plane GLPP, like a Glaſs-Window, to be fixed perpendicularly upon the Ground OP, between the Spectator HE, and the Object TOSX; and it will be as evident, that the Rays TE, OE, SE, and XE, will be cut by the tranſparent Plane GLPP, in the Points tosx; which Points are called the Projection, or in other Words, the Perſpective Repreſentation of the correſponding Points TOSX, of the Original Object.* And if Lines are drawn from the ſeveral Points tosx, ſo as to join each

other, the Figure ſo deſcribed, will be the Projection, or Perſpective Repreſentation, of the whole original Figure TOSX, upon the Picture.

---

* See Definition 6, Sect. II. of this Chapter.

Fig. 42. In like Manner; ſuppoſe TOSX to be raiſed perpendicular to the Ground OP, and parallel to the Picture, but every thing elſe remaining in the ſame Situation as in the former Figure; then will tosx be the Repreſentation of TOSX: For it is the Section of the Picture with the Rays TE, OE, SE, and XE, which comes from the original Object to the Eye. And here let us obſerve, that when the original Object is parallel to the Picture, its Repreſentation, tosx, will not only be parallel to the Original, but exactly like it, though ſmaller in Proportion as the original Object is farther from the Picture; and if the Original be brought to G, ſo as to coincide, or touch the Picture, then the Repreſentation will be equal to the Original: But on the contrary, the Original may be ſuppoſed ſo far removed from the Picture, that the Angles, which the Rays ſubtend at the Eye, growing ſmaller and ſmaller continually, it will at laſt totally diſappear, and conſequently its Repreſentation upon the Picture will diſappear alſo. Again, when the Original is brought to coincide with the Picture, the Repreſentation of TX will not only be equal to the Bottom of the Original, but will be at the Bottom of the Picture, in the Line GL, which is its Section with the Ground Plane OP: But as the Original is removed farther and farther from the Picture, the Repreſentation will riſe higher and higher, 'till at laſt, the Original being ſuppoſed at an infinite Diſtance, its Repreſentation will vaniſh into an imaginary Point C, exactly as high above the Bottom of the Picture as the Eye is above the Ground, or original Plane OP, upon which the Spectator, the Picture, and the original Object are now ſuppoſed to ſtand. And ſo alſo in regard to Objects that lie flat upon the Ground; when their Sides are parallel, then the Repreſentations of thoſe Sides will be parallel alſo: Thus the Repreſentation tx of TX, and os of OS, are parallel to their Originals, but ſeverally diminiſhed in proportion to their Diſtance from the Picture; and therefore the Repreſentation of their oblique Sides TO, XS, which muſt join tx, os, to compleat the Repreſentation of the whole original Figure, cannot be parallel to their Originals, but will be oblique in the Picture, and would, if continued towards the Top of the Picture, converge into an imaginary Point C, exactly as high above the Bottom of the Picture, as the Eye is above the original Plane OP. Now theſe Points, into which Fig. 41.

which we ſuppoſe the Repreſentations of Objects do vaniſh upon the Picture, are called by the general Name of Vaniſhing Points.

From hence then, we may form an Idea of the Nature of the Perſpective Plane or Picture, and of Perſpective Repreſentations; which Repreſentations are nothing more than the Section which the Picture makes with the Rays of Light in their Paſſage from original Objects to our Eyes; and that the whole of this Art, depends upon finding the exact Section, or true Shape, which that cutting of the Rays makes upon the Picture in all kinds of Situations, and in giving them their proper Force and Colour.

But to illuſtrate this by a very familiar Inſtance. Suppoſe a Spectator to be looking at a Proſpect without Doors, from within, through a Glaſs-Window; he will perceive not only the vaſt Extent which ſo ſmall an Aperture will admit to be ſeen by his Eye, but the Shape, Size, and Situation, of every Object upon the Glaſs: If the Objects are near the Window, the Spaces which they take upon the Glaſs will be proportionably larger than when they are at a greater Diſtance; if they are parallel to the Window, then their Shapes upon the Glaſs will be parallel alſo; but if they are oblique, then their Shapes will be oblique, and ſo on. And he will aways perceive, that as he alters the Situation of his Eye, the Situation of the Objects upon the Window will be altered alſo: If he raiſes his Eye ever ſo high, the Objects will ſeem to keep pace with his Eye, and riſe higher upon the Window; and the contrary, if he places it ever ſo low. And ſo in every Situation of the Eye, the Objects upon the Window will ſeem to riſe higher or lower; and conſequently, the Depth of the whole Proſpect will be proportionably greater or leſs, as the Eye is elevated or depreſſed; and the Horizon will, in every Situation of the Eye, be upon a Level with it: That is, the Horizontal Line, or that imaginary Line which parts the Earth and Sky, will ſeem to be raiſed as far above the Ground upon which the Spectator ſtands, as his Eye is remov'd from the ſame Place.

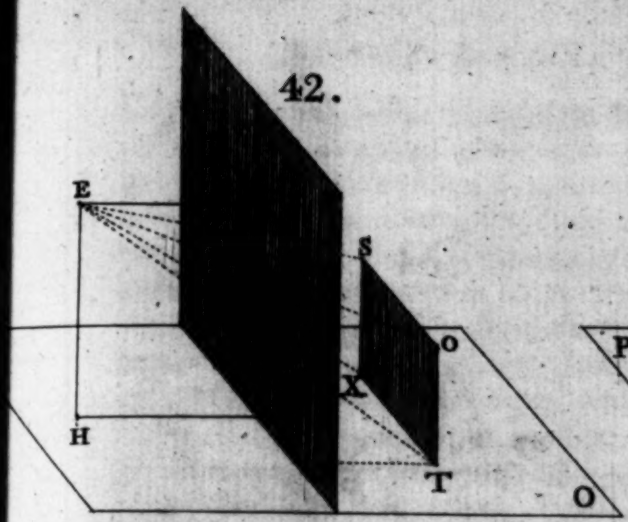
Fig. 43. Let us now ſuppoſe two Planes A B a b, C D c d, of the ſame Height, and parallel to each other, one to paſs through the Eye E, the other through any Point as e, and both to be perpendicular to the Ground ABCD; and let us imagine another Plane, a b c d, to be laid upon theſe two Planes, A B a b, C D c d, as in the Figure, and it will be evident, that this Plane a b c d, is parallel to the Ground A B C D, becauſe it lies upon two Planes A B a b, C D c d, of the ſame Height. Now if we ſuppoſe this Plane, a b c d, to be con-

tinued at an infinite Diſtance, and the Line c d to repreſent a Part of the real Horizon, and then imagine a Picture GLPP, to be placed between the Eye E, and the Horizon c d; then its Section HL, with the horizontal Plane a b c d, will be the indefinite Repreſentation of the Horizon c d, upon the Picture; and this Repreſentation is called the Horizontal Line. Now ſince all Objects which lye flat upon the Ground, or are parallel to it, ſeem to vaniſh into the real Horizon, therefore the Repreſentation of all ſuch Objects upon the Picture, muſt vaniſh into this Horizontal Line; becauſe, it is the perſpective Repreſentation of the real Horizon: And for the ſame Reaſon, the Ground, or whole Extent between the Eye, and the real Horizon, will not appear to lye flat, but to riſe upwards. For let E be the Eye, ABCD the Ground, Fig. 44.
and HI the utmoſt Extent which the Eye can diſtinguiſh; now, I ſay, the Ground will not appear to lie flat, as ABCD, but to riſe upwards, like ABcd, 'till it cuts the Plane a b c d, which is drawn through the Eye E, parallel to the original Plane ABCD; and the Section c d, which the Planes AB c d and a b c d make with each other, will repreſent the real Horizon. And, as before, if we ſuppoſe a Picture, GLPP, to be fixed between the Eye and the ſaid Horizon; then the Section HL, which the Picture makes with the parallel Plane a b c d, will be the indefinite Repreſentation of the Horizontal Line upon the Picture; becauſe the Rays of Light, in their Paſſage from the Section c d, or real Horizon, would cut the Picture in the Line HL.

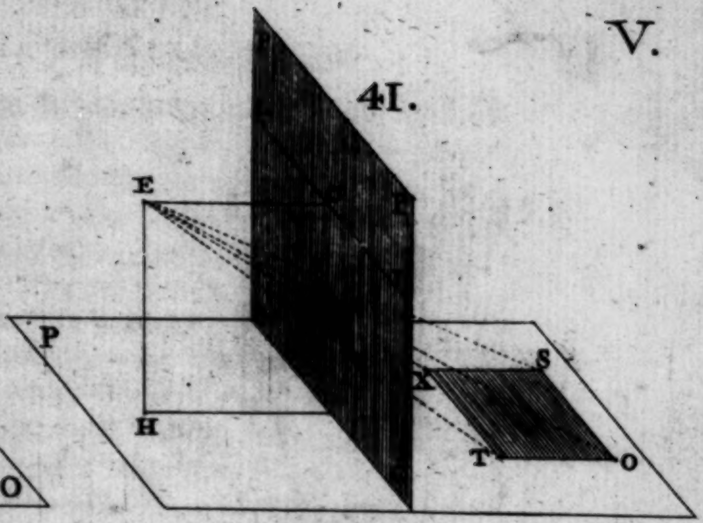
From hence, then, we may ſee the grand Principle upon which Perſpective depends; namely, upon finding thoſe Lines and Points into which Objects ſeem to vaniſh upon the Picture. And whoever will give himſelf the Trouble to underſtand the following ſhort Theory, will have maſtered all the Difficulty in Perſpective: For it only requires to have a clear Idea of the Nature and Property of vaniſhing Lines and vaniſhing Points, and a few other Requiſites as previous thereto; which he may partly conceive by what has been ſaid already, and by conſidering, that as the Horizontal Line HL, is produced by means of the Plane a b c d, which paſſes through the Eye parallel to the Ground, or original Plane; ſo, in the very ſame Manner, all other vaniſhing Lines are determined; namely, by imagining a Plane to paſs through the Eye, parallel to thoſe Planes whoſe Repreſentations are required upon the Picture. ---Again, in regard to vaniſhing Points; they are determined by drawing Lines from the Eye, parallel to the original Lines, 'till they cut the Picture; in order to which, we muſt always ſuppoſe theſe Lines to lie in ſome Plane, and then, having found the vaniſhing Line of that Plane, the vaniſhing Point of any Line, in that Plane, may be found alſo. And from hence we may obſerve, that the Horizontal Line is of the ſame Nature with any other vaniſhing Lines, and differs from them only in being more uſeful; becauſe, many more Objects are perpendicular and parallel to the Picture, than oblique with it: And therefore, the great Streſs which hath been laid upon this Line by moſt Writers, is not ſo very ſignificant as they apprehended; for, in ſome Caſes, it is of no uſe at all in a Picture. For let us conſider a little. If vaniſhing Lines upon the Picture, are always to be produced by Planes paſſing through the Eye, parallel to original Figures, then no original Plane can have its vaniſhing Line in the Horizontal Line, unleſs it is parallel to the Ground; but, if any Object be obliquely ſituated with regard to the Ground, then, the Plane which is to paſs through the Eye, parallel to the Original, in order to determine its vaniſhing Line, will be oblique with the Ground alſo; and therefore it cannot paſs through the Horizontal Line, but will be either above, below, perpendicular to it, or croſs it in an oblique manner: All which may be conceived by inſpecting the following Figures. In Fig. 45, the original Object, TOSX, lies upon the Ground; therefore, the Plane, a b c d, which paſſes through the Eye E, parallel to the Ground, cuts the Picture in the Horizontal Line HL. In Fig. 46, the Original, TOSX, is ſuppoſed perpendidular to the Ground, and to be perpendicular to the Picture alſo; therefore, the Plane ABPD, which paſſes through the Eye E, parallel to the ſaid Plane, will be perpendicular to the Ground and perpendicular to the Picture; and therefore will paſs through the Center C, of the Picture, and produce the vaniſhing Line PD, which will be perpendicular to the Horizontal Line HC. But, if the original Object is perpendicular to the Ground, and oblique with the Picture, as in Fig. 47; then its vaniſhing Line PD, will be perpendicular to the Horizontal Line HL, but, will not paſs through the Center or Middle of the Picture, but will be on one Side of it. Again, if the ſquare Object ABTS, Fig. 48, (which is inclined to theGround, at the Angle ATO, but reclined to the Picture) have two Sides AB, TS, parallel to the Picture; then the Plane OPVL, which paſſes through the Eye E, parallel to the original ABTS, will produce a vaniſhing Line VL, above the Horizontal Line HC, and exactly parallel to it. But if the ſame

V.

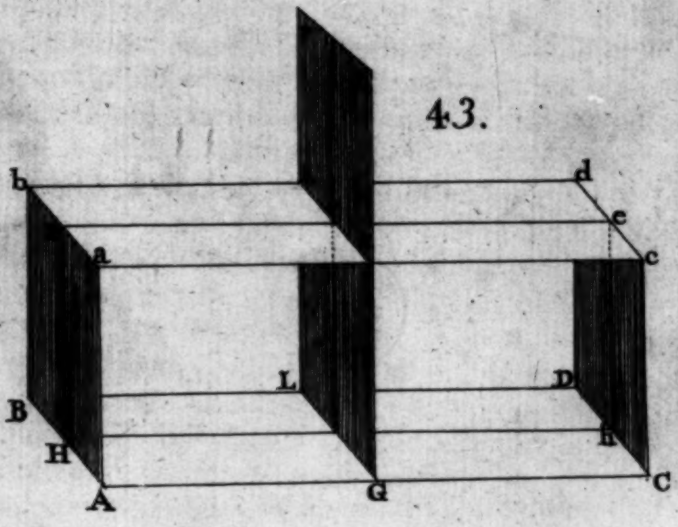
42.



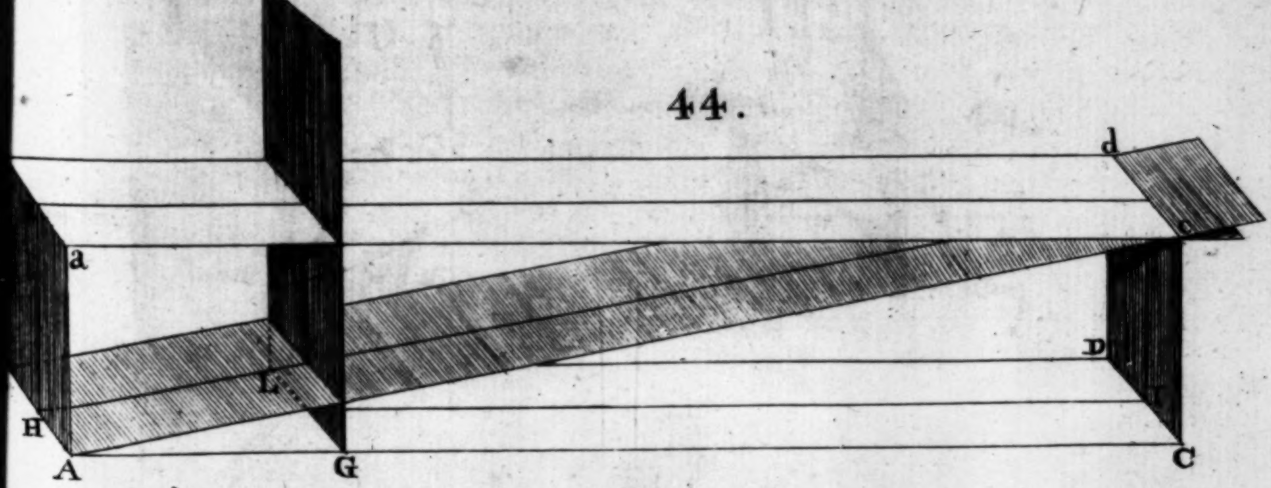
41.



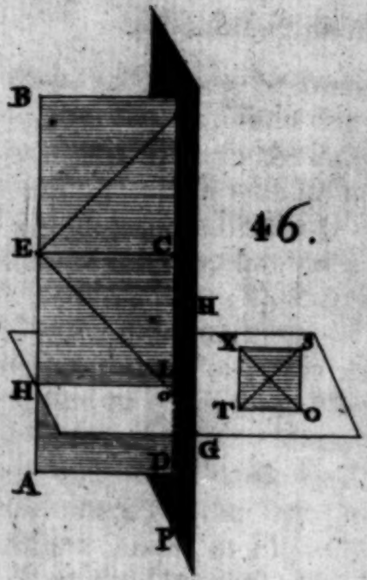
43.



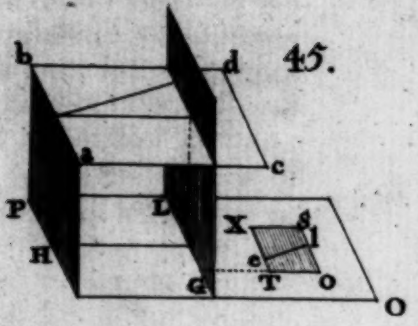
44.



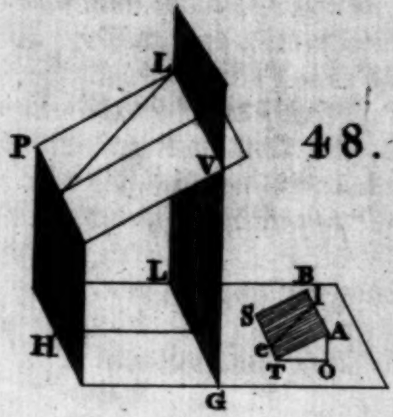
BRITISH
1 JY64
MUSEUM



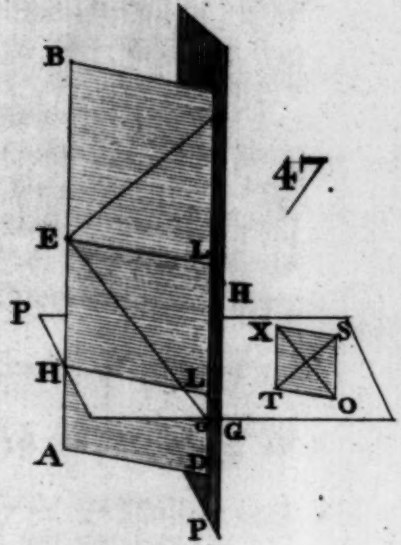
46.



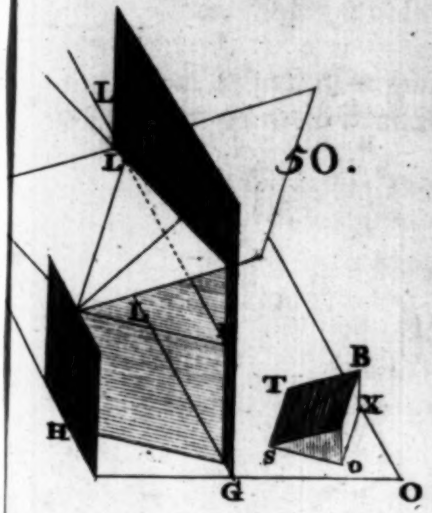
45.



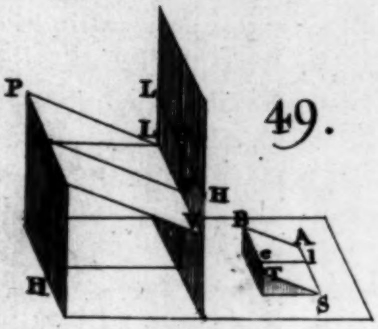
48.



47.



50.



49.

BRITISH
1 JY64
MUSEUM

Object, (Fig, 50) be turned ſo as to have all its Sides oblique with the Picture, then the Plane EPLV, which paſſes through the Eye E, parallel to the original ABTO, will produce a vaniſhing Line VL, which will be aſlant the Horizontal Line HL. Again; if the Object, ABCO, (Fig. 49) be inclined both to the Ground and the Picture, but have its Sides AO, BC, parallel to the Picture, (as in Fig. 48) then its vaniſhing Line, VL, will be parallel to the Horizontal Line, HL, but below it. And ſo in regard to the vaniſhing Points of any original Lines: As theſe Lines are ſuppoſed to lie in ſome Planes, therefore, having found the vaniſhing Lines of thoſe Planes, as above, the vaniſhing Point of any Line in thoſe Planes may be eaſily found alſo; *viz.* by drawing Lines through the Eye, parallel to ſuch Lines, 'till they cut the Picture: Thus, in Fig. 45, EL is drawn from the Eye, E, parallel to the Original, e l, and therefore L is the vaniſhing Point of el upon the Picture. And ſo again in Fig. 47, Es, EL, and Eo, are parallel to the Originals ST, SX, OT and OX, and therefore will produce the correſponding vaniſhing Points; *viz.* s for the Line ST, L for the Lines SX and OT, and O for the Line XO. In like Manner the Point L, in Fig. 48, 49, 50, are determined; *viz.* by drawing the Lines EL, from the Eye, parallel to the Originals el and OB.--From hence, then, we may perceive, that the various Situations of Objects may be reduced under three general Heads, *viz.*

1. When they are perpendicular to the Picture, or parallel to the Ground.
2. When they are parallel to the Picture, or perpendicular to the Ground.
3. When they are obliquely ſituated, both as to the Picture and the Ground, or any other Plane upon which we ſuppoſe them: All which I ſhall now endeavour to explain in their ſeveral Orders, and apply them to Practice.

SECT. II.

DEFINITIONS.

1. THE *Point of Sight*, is that Point where the Spectator's Eye is placed to look at the Picture. Thus the Point E, of all the Figures in Plate 6, is the Point of Sight, or Place of the Eye.

Fig. 45. 2. If from the Point of Sight E, a Line, EC, be drawn perpendicular to the Picture, GLHL, the Point C, where that Line cuts the Picture, is called the *Center of the Picture*.

3. The *Diſtance of the Picture*, is the Length of the Line EC, which is drawn from the Eye, perpendicular to the Picture.

Fig. 48, 49, 50. 4. If from the Point of Sight E, a Line EP, be drawn perpendicular to any vaniſhing Line VL; the Point P, where that Line cuts the vaniſhing Line, is called the *Center of that vaniſhing Line.*

5. The *Diſtance of a vaniſhing Line*, is the Length of the Line EP, which is drawn from the Eye perpendicular to the ſaid Line.

6. By *Original Object*, is meant the real Object, whoſe Repreſentation is ſought, whether it be a Line, Point, or plane Figure: And by *Original Plane*, is meant that Plane upon which the Fig. 45. real Object is ſituated; thus the Ground, OP, is the Original Plane, and TOSX the Original Object.

7. That Line GL, where an original Plane OP cuts the Picture, GLHL, is called the *Section of the Original Plane*, or the *Ground Line*.

8. If any Original Line, OT, be continued, ſo as cut the Picture; the Point G, where it cuts the Picture, is called the *Interſection of that Original Line*.

9. The *Vaniſhing-Line of any Original Plane*, &c. is that Line, where a Plane drawn through the Eye, parallel to that Original Plane, cuts the Picture: Thus HL in this Figure, and VL in Fig. 48, 49, 50, are the vaniſhing Lines of their ſeveral Original Planes, TOSX and ABTS.

10. The *Vaniſhing Point of any Original Line*, is that Point where a Line drawn from the Eye, parallel to that Original Line, cuts Fig. 48. the Picture: Thus EL, being parallel to the Original el, produces the vaniſhing Point L; and ſo on.

THEOREM I.

Fig. 51. If two or more Planes, ABCD, EFGH, are parallel to each other, they will have the ſame vaniſhing Line HL.

For let GHLL be the Picture, E the Spectator's Eye, and ABCD an original Object.

Imagine the Plane HIKL to paſs through the Eye E, parallel to the original Object ABCD, and it will cut the Picture in the Line HL, which will be the vaniſhing Line of the original Plane ABCD: And ſince the other original Plane EFGH, is parallel to ABCD, therefore the Plane HIKL is parallel to that alſo; and therefore HL is the vaniſhing Line of the Plane EFGH, and of every other Plane which is parallel to ABCD.

THEOREM 2.

The vaniſhing Points, H and L, of Lines AC, BD, in any original Plane ABCD, are in the vaniſhing Line HL, of that Plane.

From the Eye E, draw EH, EL, parallel to BD and AC; then becauſe the original Plane ABCD, and the Plane HIKL, are parallel; therefore the Lines EH, EL, that are drawn from the Eye E, parallel to the original Lines BD, AC, will be in the Plane HIKL; and conſequently muſt cut the Horizontal, or vaniſhing Line, HL, in the Points H, L, and thereby produce the proper vaniſhing Points of the original Lines BD, AC.

THEOREM 3.

If the original Plane ABCD, is parallel to the Picture, GHLL, Fig. 52.
it can have no vaniſhing Line upon the Picture, and therefore its Repreſentation will be parallel, as in Fig. 42. becauſe its parallel Plane abcd, which paſſes through the Eye E, can never cut the Picture, and conſequently, can produce no vaniſhing Line upon it. And ſo in regard to the Line BD: It can have no vaniſhing Point upon the Picture, but its Repreſentation will be parallel to the Original, as o s, t x, in the above Figure.

THEOREM 4.

The Repreſentation ab, of a Line AB, is a Part of the Line Fig. 53, 54.
GC, which paſſes through the interſecting Point G, and the vaniſhing Point C, of the original Line AB.

For imagine the Plane AHEF, to paſs through the Eye E, and the original Line AB, and it will paſs through both the inſecting Point G and the vaniſhing Point C, and cut the Picture in the Line GC: And if the viſual Rays, AE, BE, are drawn from the Object to the Eye, they muſt be in the Plane AHEF, and conſequently, their Section ab with the Picture, will be in the Section GC of that Plane with the Picture; therefore, ab, which is a Part of the Line GC, is the Repreſentation of the Line AB.

COROL. 1.

When the Original is perpendicular, as AB, Fig. 53, then its vaniſhing Point will be in the Center C, of the Picture; becauſe a Line drawn from the Eye perpendicular to the Picture, determines its Center; and therefore, ſince AB is perpendicular to the Picture, EC is parallel to it, and conſequently will produce the Center C, for the vaniſhing Point of AB.

COROL. 2.

If the Original AB, is in a Plane OPB, perpendicular to the Picture, but lies obliquely in that Plane, in regard to the Picture, Fig. 54. as AB; then its vaniſhing Point L, will be in the Horizontal Line HL, but on one Side of the Center C: And ſo whatever be the Situation of any original Line, its Repreſentation upon the Picture will always be in that Line which is drawn through its Interſection and vaniſhing Point.

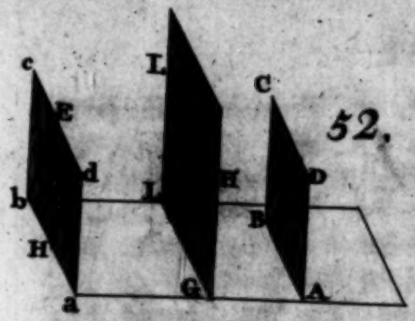
COROL. 3.

Fig. 55. For let AB be inclined to the original Plane OP, at the Angle ABD.

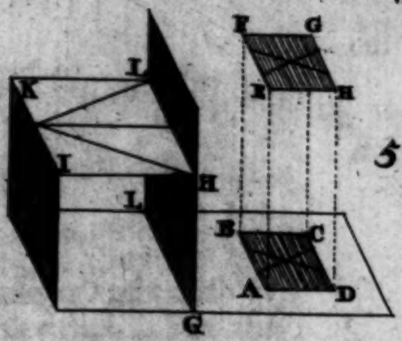
Continue AB 'till it cuts the Picture in G, and from the Eye E, draw EF parallel to it, which will cut the Picture in the vaniſhing Point F; then draw FG, and the viſual Rays AE, BE, cutting FG, in a and b; then will the Line ab be the Repreſentation of the Original AB, and is a Part of the Line FG, which paſſes through the interſecting Point G, and the vaniſhing Point F, of the Original AB. This, from what was obſerved above, is ſelf-evident; becauſe the Rays AE, BE, are in the Plane AFEG, which paſſes through the Eye and the original Object, and therefore muſt cut the Picture in the Section FG.

COROL. 4.

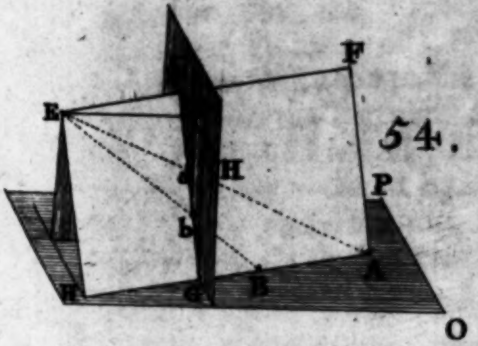
From hence it follows, that all Lines which are parallel to each other, but not parallel to the Picture, will have the ſame vaniſhing Point; becauſe a Line which paſſes through the Eye, being parallel to one, is parallel to all the reſt; and therefore can produce but



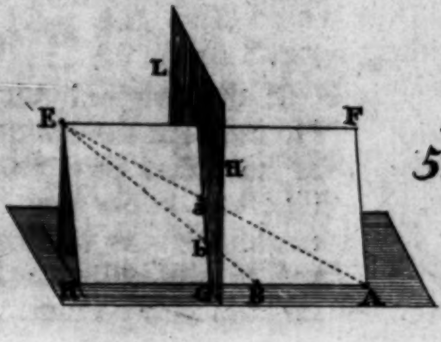
52,



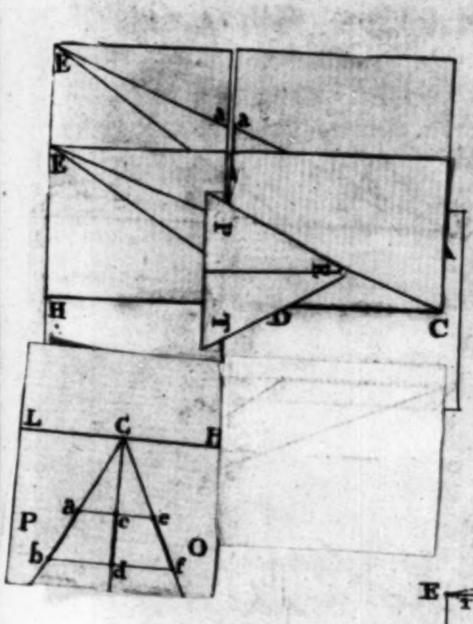
51.

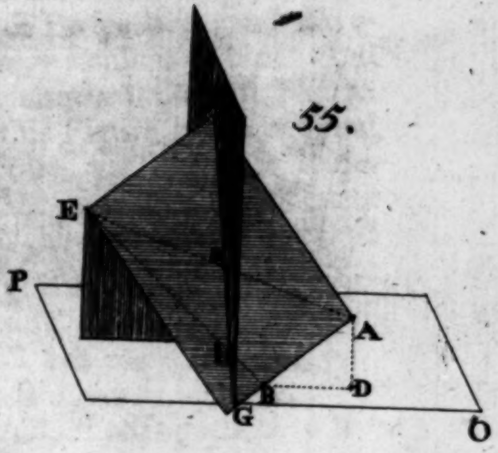


54.

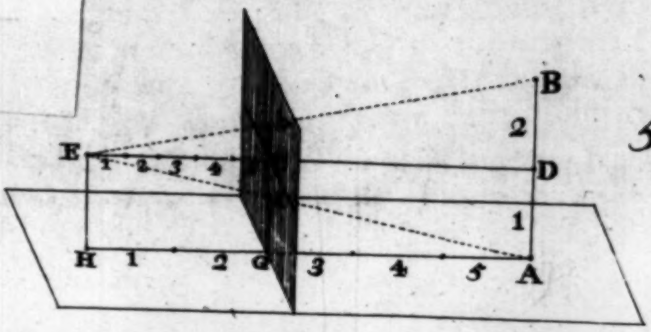


53.





55.



56. 2.

BRITISH
1 JY64
MUSEUM

one vaniſhing Point let the Number of parallel Lines be ever ſo many. This I have explained by Paper Planes, where OPHL is the Picture, TPE a Plane which paſſes through the Eye parallel to the Picture, and AB, CD, EF three original Lines parallel to each other. Now if we raiſe the Picture OPHL, and the Plane TDE, 'till they are perpendicular to the original Plane AEKI, and then turn the other Planes, which paſs through the original Objects AB, CD, EF, 'till they coincide with the Eye at E; they all will meet upon the Picture in the Point C, which is the common vaniſhing Point of all the original Lines AB, CD and EF. And by obſerving the viſual Rays, which are drawn from the Extremities of every original Object to the Eye, at E, we may perceive that the Repreſentation of the Line AB, will be ab upon the Picture; of CD, cd; and of EF, ef: All which Repreſentations will tend to the Point C, as a common Center, and there vaniſh into the Picture. And we may moreover obſerve, that ſince the original Lines AB, CD, EF, are not only equal and parallel to each other, but at equal Diſtances from the Picture or Section GL; that therefore their Repreſentations will be at the ſame Diſtance from the Section, GL, of the original Plane, and between the ſame parallel Lines ae, bf. Fig. 56.

This laſt Theorem, and the Corollaries deduced from it, are the principal Foundation of all the Practice of Perſpective; and therefore the Reader will do well to make it very familiar to him: And to help his Reflections upon it, I have annexed the laſt Figure. But although I have confined myſelf in this Figure to an original Plane which is perpendicular to the Picture, yet the ſame Rules will ſerve for any other original Planes, be they ever ſo obliquely ſituated in regard to the Picture; provided they are parallel amongſt themſelves: As muſt appear extremely obvious by a little Attention in examining the Figure.

THEOREM 5.

The Repreſentation ab, of any Line AB, that is parallel to the Picture, is to its original Line AB, as the Diſtance EC of the Repreſentation ab, is to the Diſtance ED of the original Figure. For let the original Figure AB be two Parts, and the Diſtance ED (or which is the ſame Thing, AH) five Parts; and the Diſtance EC, (or HO) of the Repreſentation ab, two Parts; then will AB be to its Diſtance ED as five to two. For if we divide the Fig. 56. No. 2.

the Diſtance CE of the Repreſentation ab, into five Parts, then the Repreſentation ab will be equal to two of thoſe Parts; that is, as five is to two. Again, the Diſtance Ca, between the vaniſhing Point C, of a Line AO, and any Point a in its Repreſentation Oa; is to the Diſtance CO, between the vaniſhing Point C and the Interſection of that Line; as the Diſtance EC (or HO) of the Eye, is to the Diſtance HA of the original Point. For let HA be five Parts, and HO two Parts; divide OC into five Parts, and the Diſtance Ca, between the Repreſentation a of the Point A, will be two of thoſe Parts; therefore, Ca is to CO, as HO is to HA; that is, as two is to five: As is evident by inſpecting the Figure.

From hence, then, we may obſerve, that the perſpective Repreſentations of Objects are diminiſhed upon the Picture in an harmonical Proportion; and that, if the Length of any original Object, its Diſtance, together with the Diſtance and Height of the Eye, are known, that then the Appearance of thoſe Objects upon the Picture may be found by Calculation; which will be exemplified in the practical Part. Proceed we, therefore, in our propoſed Order*, to determine the Repreſentations of Objects which are in Planes variouſly ſituated in regard to the Picture.

SECT. III.

Of OBJECTS which are in Planes perpendicular to the Picture.†

Fig. 57. No. 1. LET ABCD be a ſquare Object lying flat on the original Plane OGLP, and let E be the Eye, and EC its Diſtance.

From what has been ſaid already it is manifeſt, that abcd is the Repreſentation of ABCD; for the Points a, b, c, d, are where the viſual Rays BE, &c. are cut by the Picture, as was obſerved in Fig. 41, 42. Or the Repreſentations ab, cd, are Part of the Lines TC, SC, which are drawn from the interſecting Points T and S, and the vaniſhing Point C, of the original Lines AB, CD; as was ſhewn in Fig. 53, 54. and conſequently ad, bc, are the Repreſentations of their Originals AD, BC.

---

[*] Vide Page 25.

[†] The original Plane OGLP, which is perpendicular to the Picture, I ſhall always ſuppoſe the Ground, unleſs mention be made to the contrary; becauſe it will be more intelligible to the Generality of Readers, and becauſe I ſhall make great uſe of this Plane, and of its vaniſhing Line HL, as being the Horizontal Line.

Now let us ſuppoſe the original Plane OGLP, to be turned upon its Section GL; and the parallel Plane HIKL to be turned alſo upon the vaniſhing Line HL, 'till thoſe Planes and the Picture become one ſtrait Plane, like 𝔒𝔓𝔍𝔎; then it is manifeſt that the Eye E, will be tranſpoſed into the Point 𝔈, and 𝔈C will be equal to its Diſtance. And if we moreover ſuppoſe the original Figure ABCD, to be drawn upon the under Side of the Plane OGLP, and exactly in the ſame Situation, as 𝔄𝔅ℭ𝔇 in the Plane 𝔒GL𝔓; now, I ſay, if Lines are drawn from the ſeveral Points 𝔄𝔅ℭ𝔇 in this tranſpoſed Plane, to 𝔈, the tranſpoſed Place of the Eye, that their Sections a, b, c, d, with the Lines TC, SC, will be in the very ſame Points, in which thoſe Lines are cut by the Rays, which goes from the original Points ABCD, in the Plane OGLP to the Eye E: Thus the Ray BE, cuts the Line TC in b; and if a Line is drawn from 𝔅 to 𝔈, it will cut TC in the ſame Point b; and ſo of the reſt. From whence it follows, that the Repreſentation abcd, may be as exactly determined by thus tranſpoſing the Planes, as by thoſe imaginary Rays of Light which go from the real Object to the Eye.

That the Senſe of this Figure may be the more clearly comprehended, in Fig. 57, No. 2. are all the above Planes laid flat upon the Paper; and may eaſily be diſtinguiſhed by the Letters which denominate each Plane: Thus OPLG is the original Plane, ABCD the original Object, T and S the Section of the Sides AB, CD, with the Picture GLHL: The parallel Plane is HIKL; and HL the vaniſhing Line of the original Object: C the Center of the Picture; E the Eye; and EC its Diſtance. Theſe Things being premiſed, let us apply them to Practice by determining the above Repreſentation.

From T and S draw TC, SC, and from the ſeveral Points A, B, C, D, draw Lines to the Eye at E, which will cut TC, SC, in the Points a, b, c, d; then draw ad, bc, parallel to HL, and the Repreſentation is compleated. Fig. 57. No. 2.

From hence, then, it follows, that if the Situation, or Seat of an original Object, together with the Place of the Picture, and the Diſtance of the Eye, are known, that then the Repreſentation of that Object may be eaſily determined: For let us now, without any Regard to the former Figure, call OPGL the Ground, ABCD an original Object, GLHL the Picture, HL the Horizontal Line, C the Center of the Picture, and CE the Diſtance of the Eye.

From the Eye E draw EC, parallel to the Sides AB, CD of the Original, which will cut the vaniſhing Line HL, in C, the Center of the Picture; becauſe AB and CD are perpendicular to the Picture, that is, perpendicular to the Section GL; therefore C is the vaniſhing Point of AB and CD.—Continue the Sides AB, CD, 'till they cut the Section GL in T and S. From T and S draw Lines to C; then from the ſeveral Points A, B, C, D, draw Lines to E, which will cut TC, SC, in the Points a, b, c, d: Finally, draw the Lines a d, b c, which will give the Repreſentation required.

This Repreſentation may alſo be determined without drawing Lines from the original Points A, B, C, D, to the Eye E, by means of the Diagonal AC continued, and its parallel EN.

Continue the vaniſhing Line HL, and the Section GL, at Pleaſure; continue alſo the Diagonal AC, 'till it cuts the Section in M: From E, draw EN, parallel to AC; and from N, where it cuts the vaniſhing Line, draw NM, cutting TC, SC, in the Points a and c; then is a the Repreſentation of A, and c the Repreſentation of C; therefore from a and c, draw a d, b c, parallel to HL, and the Thing propoſed is done.

Fig. 58. For let ABCD be an original Square, AC, BD, Diagonals drawn in it; and let ABcd be its Repreſentation upon the Picture.—C is the Center of the Picture, and CE its Diſtance.

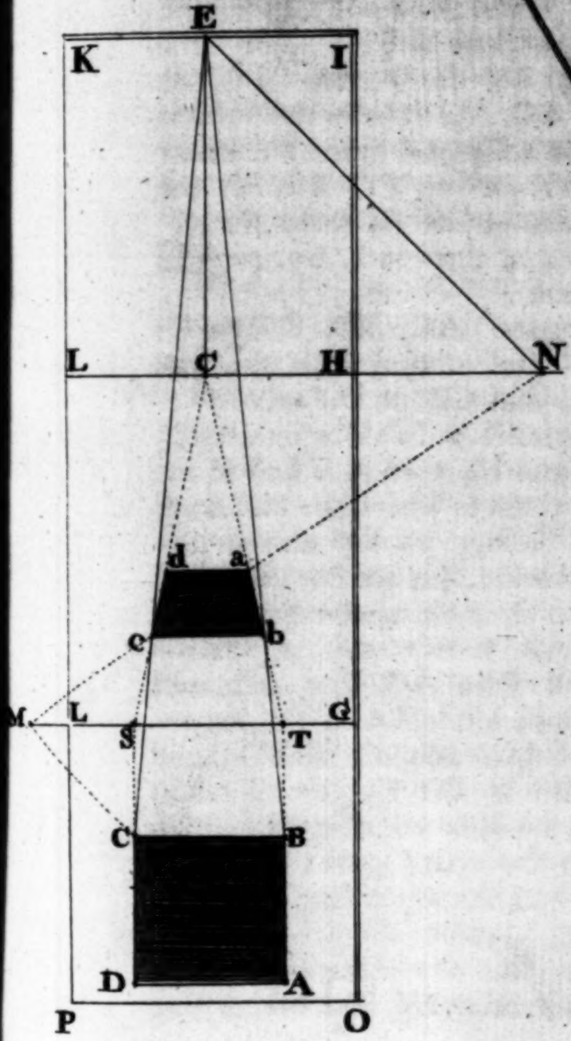
Through E, draw EL and EH, parallel to the Diagonals AC, BD, cutting the vaniſhing Line in L and H; then is L and H the vaniſhing Points of thoſe Diagonals; for it is where the Picture is cut by Lines which are drawn from the Eye parallel to the Originals AC, BD. And for the ſame Reaſon, (as we have obſerved before) C is the vaniſhing Point of AD, BC; and therefore, if Lines are drawn from the Sections AB, to the vaniſhing Points HCL, their mutual Interſections c, d, with AC, and BC, will determine their ſeveral Repreſentations: Thus Ad is the Repreſentation of AD, Bc of BC, Ac of AC, and Bd of BD; and by drawing cd, (which will be parallel to the Horizontal Line) the Repreſentation of the whole Square will be compleated.

The practical Part is repreſented by the 25th Figure; where all the Planes are laid down, as before; with correſponding Letters to diſtinguiſh them.

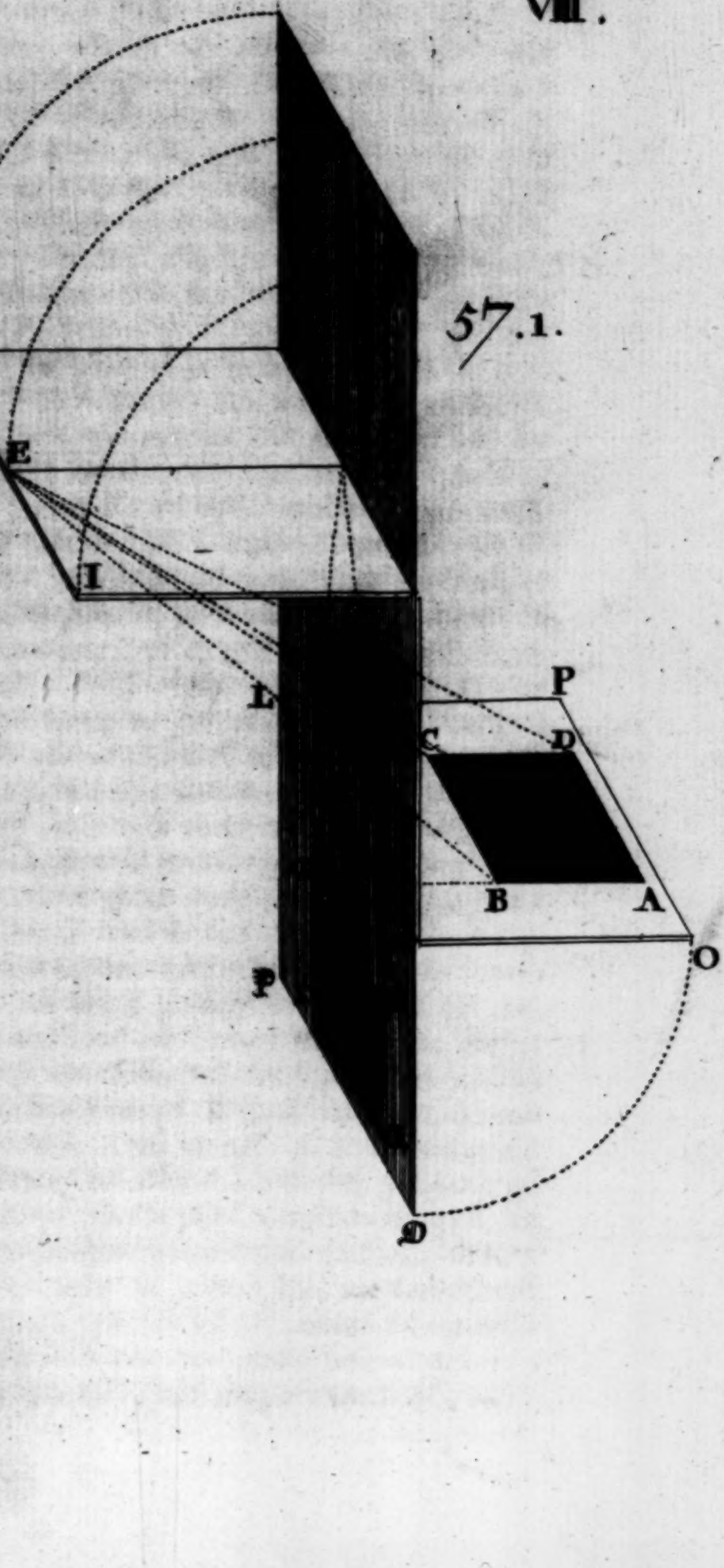
From hence, then, we may obſerve, that any plane Figure may eaſily be drawn upon the Picture by reſolving the whole into Triangles.

VIII.

57.2.

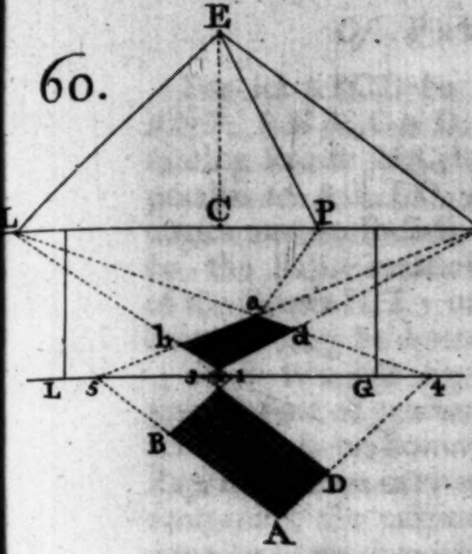


57.1.

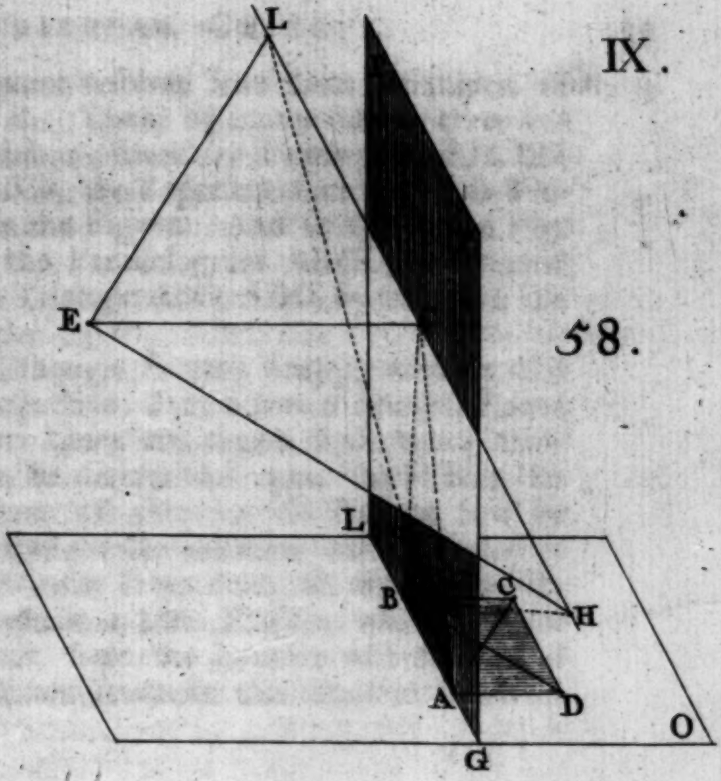


BRITISH
1 JY64
MUSEUM

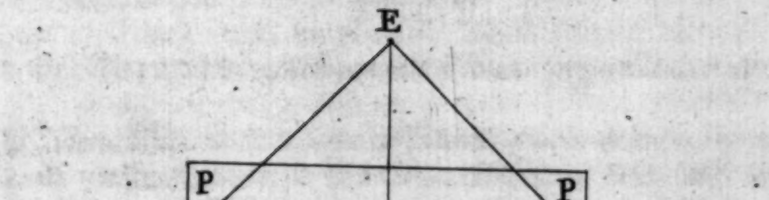
60.



58.



59.



BRITISH
1 JY64
MUSEUM

For let ABCD be a Square reſolved into four Triangles, as AND, ANB, CND, CNB. Then, by means of the three vaniſhing Points H, C, L, which are found by drawing EC, EH, EL, parallel to AB, BC, AC, BD, the Repreſentations of thoſe Triangles may be found; as in the Figure. And ſo likewiſe in Fig. 60, the Repreſentation of the Parallelogram ABCD, by means of the Points H, L; or any Triangle ABC, ADC, by means of the Point P, may be determined. Fig. 59.

Theſe two laſt Figures, though ſo very ſimple, contain the greateſt Part of practical Perſpective: For, however original Planes are ſituated, or however any Lines are drawn upon them, their Repreſentations may always be determined upon the Picture, by continuing the original Lines 'till they cut the Picture, and by drawing Lines through the Eye parallel to them. All the Difficulty lies in being careful to draw the Lines from the right interſecting and vaniſhing Points; which a little Practice will make extremely eaſy: And, therefore, here the Learner will do well to exerciſe himſelf with the Examples under this Head in Book II. Sect. 2.

SECT. IV.

Of OBJECTS *which are in Planes perpendicular to the Ground.*

HEre TOSX is a ſquare Plane which ſtands upon its Side TO, perpendicular to the Ground Plane OP, and is alſo perpendicular to the Picture. Fig. 61.

Let E be the Eye, C the Center of the Picture, and CE its Diſtance.—From the Eye E, draw EH parallel to TX or OS, and EC parallel to OT: Then becauſe EC is parallel to TO and SX, therefore C is the vaniſhing Point of thoſe Lines; and therefore, from C draw CL, cutting the Section GL in L; and then from L draw LH parallel to CE, which will compleat a perpendicular Plane CEHL, that paſſes through the Eye parallel to the original Object TOSX; and therefore its Section, CL, with the Picture, is the vaniſhing Line of that original Plane. And ſince CE is by Conſtruction perpendicular to CL, therefore C is the Center of the vaniſhing Line, and alſo the Center of the Picture, and CE is its Diſtance.

* Continue CL at pleaſure; and from the Eye E, draw EA, EB, parallel to the Diagonals OX, TS, which will cut the vaniſhing Line

Line AB in the Points A and B; therefore A and B are the vaniſhing Points of thoſe Diagonals, by means of which the whole Repreſentation may be determined. Thus G is the Section of the Side OT, and C its vaniſhing Point, therefore draw GC; then from T and O draw Lines to E, which will give the Appearance t o, of T O; and from t and o draw the Lines tx, os, parallel to the vaniſhing Line AB (that is, perpendicular to the Ground Plane) and continue them at pleaſure: Finally, from A draw a Line through o, cutting tx in x, and from B draw a Line to t, which will cut os in s, then draw sx to its vaniſhing Point C, which finiſhes the Figure.

Fig. 62. But to apply this to Practice.—The Planes being ſuppoſed to be laid flat, as in Fig. 57. No. 2.

Then OT repreſents the Seat, or Plan, of the original Plane TOSX, in the laſt Figure, TG its Diſtance from the Picture, AEB the parallel Plane, E the tranſpoſed Place of the Eye, and CE its Diſtance.

From the Extremities O, T, of the Seat OT, draw T 1, O 2, at pleaſure, but parallel to each other, cutting the Section in 1 and 2; make CB equal to the Diſtance CE of the Picture, and from B draw BH, parallel to T 1, O 2, cutting the horizontal Line in H: Then is H the vaniſhing Point of the Lines T 1, O 2; therefore draw H 1, H 2, and from G draw GC, which will be cut by the above Lines in the Points t, o; and thereby give t o for the Repreſentation of TO. Again, from t and o, draw the Lines t x, o s, at pleaſure, but parallel to the vaniſhing Line AB; then from A draw a Line through o, cutting t x in x; and from B draw a Line to t, which cutting os in s, will determine the laſt Angle of the Square; and therefore, by drawing s x to its vaniſhing Point C, the whole Repreſentation will be compleated.—I have made uſe of both the vaniſhing Points A, B, to exerciſe the Learner; but one Point will do; thus, A x determines the Side tx; therefore draw xC, which will cut o s, and give the other Side o s.

Fig 61. Here let us obſerve, that when the Seat OT, of any Plane, is perpendicular to the Picture, the vaniſhing Line of that Plane will paſs through the Center of the Picture, and be perpendicular to the horizontal Line: But, if the Seat OT, Fig. 63, of any perpendicular Plane, TOSX, be oblique with the Picture, then its vaniſhing Line, AB, will not paſs through the Center of the Picture, but on one Side of it; nevertheleſs, it will always be perpendicular to the horizontal Line, and will paſs through the vaniſhing Point L, of its Seat OT.

For

Fig. 63. For, draw EL, parallel to OT, and it will cut the horizontal Line in L: From E and L, draw EH, LL, parallel to TX or OS; and from L, where LL cuts the Section GL, draw LH parallel to EL; then is the Plane LLHE parallel to the original Plane TOSX, and conſequently perpendicular to the Ground; and therefore, its Section LL, with the Picture, is the vaniſhing Line of that original Plane, and is perpendicular to the horizontal Line: And ſince the vaniſhing Point L is in the Section LL, therefore LL continued will paſs through that Point, and conſequently AB is the vaniſhing Line of the Plane TOSX. Again; ſince EL is perpendicular to the vaniſhing Line AB, therefore, L is the Center of that vaniſhing Line, and EL its Diſtance; and therefore, from E draw EA, parallel to the Diagonal OX, and EB parallel to the Diagonal TS, cutting the vaniſhing Line in A and B; then are A and B the vaniſhing Points of thoſe Diagonals; from whence the Repreſentation may be compleated, as in the former Figure.

But to apply this to Practice. Let the ſeveral Planes be ſuppoſed to be laid down as before.

Fig. 64. Then TO is the Seat of the original Object, L its vaniſhing Point, C the Center of the Picture, EC its Diſtance, L the Center of the vaniſhing Line AB, and EL its Diſtance.

From the Section G, draw GL to its vaniſhing Point, and from the Extremities T, O, of the Seat TO, draw two parallel Lines at pleaſure, cutting the Section GL in 1 and 2; from E, draw E 3, parallel to T 1 and O 2, cutting the horizontal Line in 3; then draw 1 3, 2 3, which will give the Repreſentation t o; again, from t and o, draw the Lines tx, os, parallel to the vaniſhing Line AB: And then, by means of the vaniſhing Points A and B, the whole Repreſentation may be compleated, as in Fig. 62.

This Figure alſo deſerves the Learner's particular Attention; for if he obſerves, in Fig. 62. the vaniſhing Line AB paſſes through the Center of the Picture, and therefore the Diſtance CE of that vaniſhing Line, is equal to the Diſtance of the Eye, or principal Diſtance: But in this laſt Figure, ſince the vaniſhing Line does not paſs through the Center of the Picture, therefore, the Diſtance EL, of that vaniſhing Line, is greater than the principal Diſtance CE, and will be proportionably greater and greater, as the vaniſhing Line is removed farther and farther from the Center of the Picture. For the principal Diſtance EC, is one Side of a right-angle Triangle ECL; but EL, the Diſtance of the vaniſhing Line Fig. 64.

AB, is the Hypothenuſe of that Angle, and therefore greater than either of the Sides EC or CL: From whence it follows, that if a Line CL be drawn from the Center of the Picture, perpendicular to any vaniſhing Line AB, the Point L, where that Line cuts the Picture, will determine the Center of that vaniſhing Line; and if a Line be drawn from the Eye to that Point, as EL, it will determine its Diſtance.*

Let us now, without any Regard to the Theory, find the Appearance of a ſquare Object ſituated like TOSX, in Fig. 63.

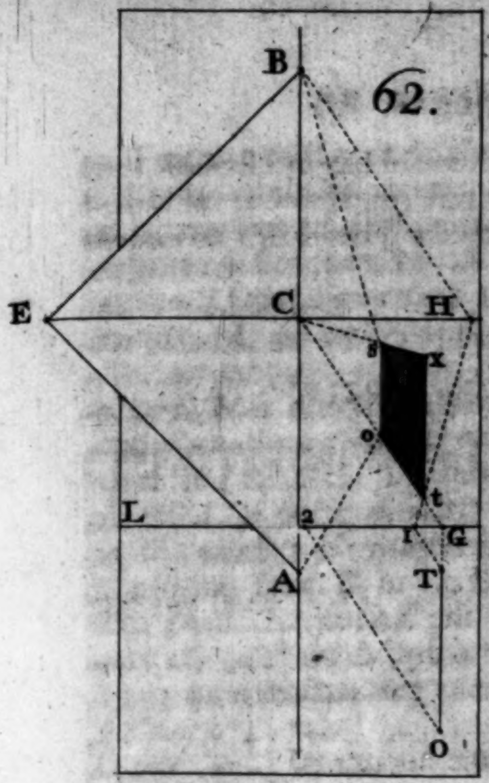
Fig. 64. Let TO be the Seat of the Object propoſed, HL the horizontal Line, C the Center of the Picture, CE the principal Diſtance, and GL the Section of the Ground Plane with the Picture. Continue the Seat OT, till it cuts the Section in G, and parallel to OT, draw EL from the Eye, cutting the horizontal Line in the vaniſhing Point L; then draw GL: Finally, draw T1, O2, and alſo their Parallel E3; by which means the Repreſentation to, may be found. Again, through the vaniſhing Point L, draw BA, perpendicular to HL, and continue the horizontal Line towards 𝕮, at pleaſure; then, becauſe CL is perpendicular to the vaniſhing Line AB, therefore L is the Center of that vaniſhing Line, and conſequently, EL is its Diſtance: Therefore continue the Perpendicular CL, at pleaſure, beyond the vaniſhing Line AB, and from L, with the Radius LE, deſcribe an Arc A𝕮BE, cutting the vaniſhing Line in A and B, and CL continued in 𝕮; then are A and B the vaniſhing Points of the Diagonals ox, and ts, and 𝕮 is the proper Diſtance of the Eye: Therefore by drawing Perpendiculars from t and o, and Lines from A and B, through the ſame Points t and o, they will cut the Perpendiculars tx, os, in x and s, and thereby give the Height of the Square; from whence, by drawing xL, it will be compleated.

From hence, then, it is manifeſt, that the Method for finding the Repreſentation of an upright Plane, is exactly the ſame as determining the Appearance of a Plane which lies flat upon the Ground, only the Situation of the vaniſhing Line is different; but the Operation in both Caſes is the very ſame; which may be conceived by turning the Figure, and imagining AB to be the horizontal Line, L the Center, and L𝕮 the Diſtance of the Picture: For then this Figure will be like Fig. 59. But that the Learner

---

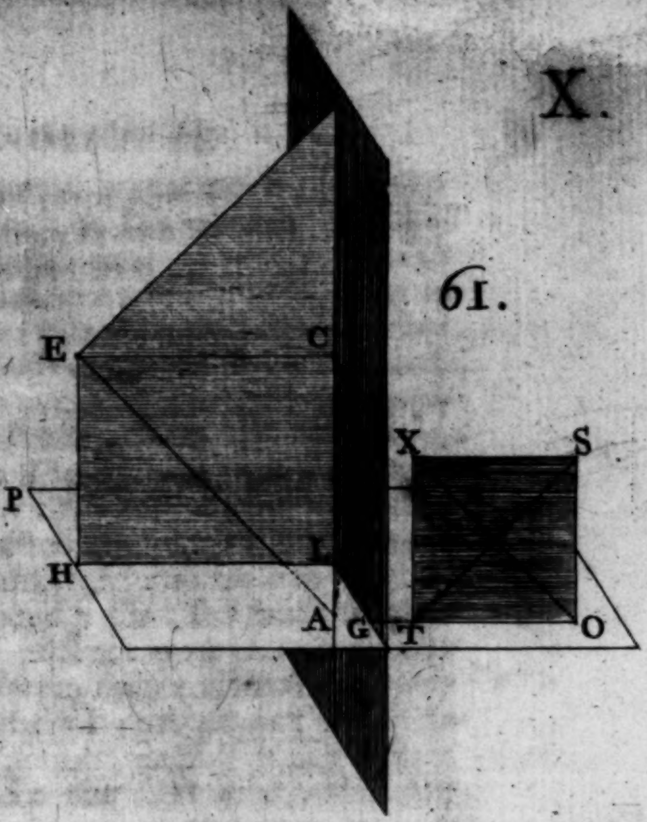
* See Definition 2, Sect. 2. Chap. 1.---alſo Definitions 4, 5, Sect. 2. of this Chapter.

may



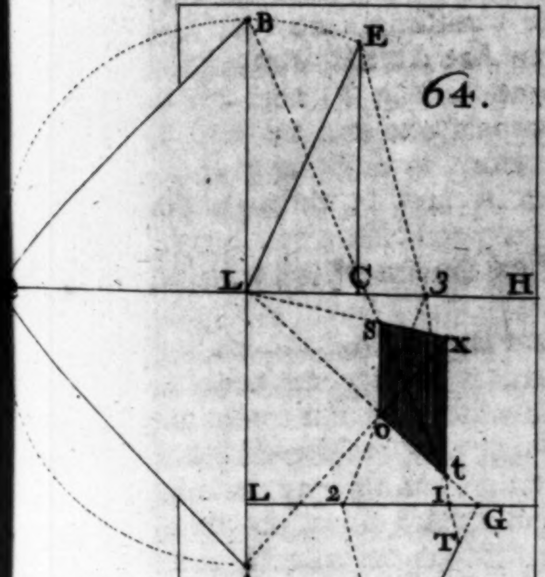
62.

B
E
C
H
s
x
o
t
L
2
1
G
A
T
O



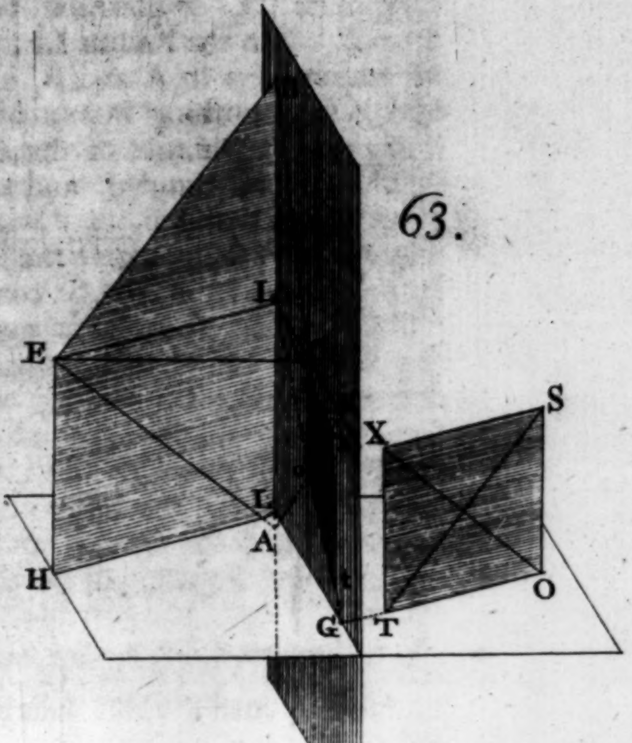
61.

E
C
X
S
P
H
L
A
G
T
O



64.

B
E
L
C
3
H
S
X
o
t
L
2
I
G
T
A
O



63.

L
E
X
S
L
A
H
t
O
G
T

BRITISH 1 JY64 MUSEUM

may underſtand the Meaning of this more perfectly, he is deſired, before he proceeds any farther, to exerciſe himſelf with ſome Examples of this Kind; which he will find in Book II. Sect. 3.

SECT. V.

Of OBJECTS *which are inclined to the Ground.*

THE Objects which come next under Conſideration, are ſuch as are neither perpendicular nor parallel to the Ground, but inclined to it; like the Roofs of Houſes, Pediments, and the like; the vaniſhing Lines of which cannot be the horizontal Line, nor any Line that is perpendicular to it.

For let TOSXYZ be the original Object, having one Side, *Fig. 65.* TOSX, upon the Ground, and one Side, TOYZ, inclined to it, at the Angle YTX; and let the other Sides be perpendicular to the Ground.—E is the Eye, C the Center of the Picture, and CE its Diſtance.

From E draw EC, parallel to XT or SO; then is C their vaniſhing Point: And becauſe TX is perpendicular to the Picture, therefore its vaniſhing Point C, is the Center of the Picture. And ſince the Plane TXY, is perpendicular to the Ground, therefore its vaniſhing Line LD, is perpendicular to the horizontal Line; and therefore, through the vaniſhing Point C, draw LD, which continue at pleaſure, then from E draw ED, parallel to TY or OZ, which will cut the vaniſhing Line LD, and give D for the vaniſhing Point of the inclined Sides TY, OZ. And if a Line, VL, be drawn through D, parallel to the horizontal Line HC, it will be the vaniſhing Line of the inclined Plane, TYZO; becauſe, if a Plane was to paſs through the Eye, parallel to TYZO, it would cut the Picture in the Line VL: And ſince ED is perpendicular to the vaniſhing Line VL, therefore D is the Center of that vaniſhing Line, and ED its Diſtance.

To apply this to Practice. Let us ſuppoſe the Planes to be laid down as in the former Figures; only for Convenience, we have removed the Seat TOSX, farther from the Middle of the Picture. ---Here TOSX is the Seat of the original Object, HL the horizontal Line, *Fig. 66.* E the Eye, C the Center of the Picture, and CE its Diſtance.

Find the Repreſentation of TOSX, as before directed, by means of the Lines O 1, S 2, and their parallel DH: Then, parallel to

the horizontal Line HE, draw a Line ab, Fig. z, at pleaſure, and through C, draw the vaniſhing Line DL, perpendicular to the horizontal Line, at pleaſure alſo: With the Line ab, and at the Point b, make an Angle abc, equal to the Angle of Inclination
Fig. 65. XTY of the original Figure; then from E, the Diſtance of the Eye or principal Diſtance, draw ED parallel to bc, cutting the vaniſhing Line in D; finally, from D draw Dt, Do, and from s draw sz, parallel to DL, which will cut oD in z; therefore, from z, draw zy parallel to to, or HE, and the thing propoſed is done.

Or the vaniſhing Point D, may be determined without the Figure z, by making an Angle at E, the Diſtance of the Eye, with the horizontal Line HE, equal to the Angle of Inclination, and then drawing ED.

In Fig. 65, the Plane TOZY is inclined to the Ground Plane, but reclined in reſpect to the Picture, and therefore its vaniſhing
Fig. 67. Line VL will be above the horizontal Line: But in Fig. 67, the inclined Plane TOZY is inclined to the Ground and to the Picture alſo; for which Reaſon, its vaniſhing Line VD will be below the horizontal Line.--The 68th Fig. repreſents the laſt Figure applied to Practice, the Operations of which are the very ſame with thoſe in Fig. 66; only the Seat TOSX, and the vaniſhing Point D, are inverted; that is, are below, inſtead of above the horizontal Line.

Fig. 65, 66, 67, & 68. From hence, then, it is evident, that D is the vaniſhing Point of all Lines which are parallel to the Sides oz and ty; and therefore, when the Figure conſiſts only of parallel Sides, as oz and ty, there will be no Occaſion for drawing the vaniſhing
Fig. 65. —— 67. Line VL or VD; ſince the vaniſhing Point D of thoſe Sides is only wanted. But if any other Lines are ſuppoſed to be drawn upon the inclined Plane, as in Fig. 69, then thoſe vaniſhing Lines become neceſſary; becauſe the vaniſhing Points of thoſe Lines will be ſomewhere in them: Which comes next under Conſideration.

Fig. 69. Let t o z y be the Repreſentation of one inclined Plane, whoſe vaniſhing Point is D; and c d e f another inclined Plane, whoſe vaniſhing Point is D; and let VDL be their vaniſhing Lines.---E is ſuppoſed the Eye, C the Center of the Picture, and CE its Diſtance.--Continue the vaniſhing Line DD at pleaſure: Then, becauſe CD is drawn from the Center of the Picture, perpendicular to the vaniſhing Lines VL, VL, therefore D, D, are the Centers of thoſe vaniſhing Lines, and DE, DE, their Diſtance from

the Eye; conſequently if DI, DI, be made equal to DE, DE, then I, I, will repreſent the tranſpoſed Places of the Eye; and therefore if Lines are drawn from the Points I, I, parallel to any original Lines, they will cut the vaniſhing Lines VL, VL, and give the vaniſhing Points of ſuch Lines. Thus, let it be required to find the vaniſhing Points of the Diagonals of a Square, t o 1 2, one of whoſe Sides t o is given.—Any where apart draw a Square, as X, at pleaſure, but in ſuch a Manner that its Sides, a b, c d, are parallel to the vaniſhing Line VL; and likewiſe draw its Diagonals.—First for the Figure t o s z y.

From I, draw IL, IV, parallel to a c, b d; which will cut the vaniſhing Line in V and L, and from t draw t L, cutting o D in 2; from o, draw o V, cutting t D in 1; then draw 1 2 parallel with t o, and then is t o 1 2 the Repreſentation of a Square upon the inclined Plane t o z y; and t 2, o 1, is the Repreſentation of its Diagonals. And was it demanded to make the Length of the inclined Plane equal to ſeveral Times its Width, as in this Figure, we may do it by means of the Points V and L; becauſe having determined one Square, all the reſt are to be found in the ſame Manner.

Here let us take Notice, that if one vaniſhing Point of any Plane is determined, all the other vaniſhing Points of Lines which can be drawn any how in that Plane, will be ſomewhere in a Line which is drawn through that Point. Thus C is the vaniſhing Point of the Side o s, which lies upon the Ground, and the horizontal Line HE paſſes through that Point: Again, C is the vaniſhing Point of o s, which is one Side of the perpendicular Plane o s z; therefore the vaniſhing Line DCD, of that perpendicular Plane, paſſes through the Point C: And ſo again, D is the vaniſhing Point of the inclined Planes, and therefore VL, VL, their ſeveral vaniſhing Lines, will paſs through the Points D, D; and conſequently, all the Lines which can be drawn in either Plane, will have their vaniſhing Points ſomewhere in the vaniſhing Lines of thoſe Planes. All which is explained by various Examples in the ſecond Book.

Hitherto I have conſidered the inclined Planes, as having one or more of their Sides parallel to the Picture, for which Reaſon the vaniſhing Lines of thoſe Planes are parallel to the horizontal Line. Let us now ſuppoſe the Plane to be ſituated in ſuch a Manner as to have all its Sides oblique with the Picture, as in Fig. 70.

Fig. 70. Where TOZY, is a ſquare Plane every way oblique with the Picture; TOSX, its Seat on the Ground; YTX, its Angle of Inclination; E the Eye; C the Center of the Picture, and CE its Diſtance.—Draw the Horizontal Line HC, and continue it at pleaſure; then parallel to TX, or OS, draw EH, cutting the Horizontal Line in H; and then is H the vaniſhing Point of the Lines TX, OS. Again, parallel to TO, or SX, draw EL, cutting the Horizontal Line in L; then is L the vaniſhing Point of the Lines TO, SX; from whence the Repreſentation of its Seat may be found. Now ſince the Plane TYX is perpendicular to the Ground, its vaniſhing Line HV will be perpendicular to the Horizontal Line; therefore from the vaniſhing Point H, draw HV parallel to XY, and EV parallel to TY, cutting HV in V; then is V the vaniſhing Point of the parallel Sides TY, OZ; and ſince L is the vaniſhing Point of TO, it is alſo the vaniſhing Point of its parallel Side YZ, and therefore, a Line drawn through V and L, will be the vaniſhing Line, (as VL) of the inclined Plane TOZY. Here let us obſerve again, that if a Line, ED, be drawn from the Eye E, perpendicular to the vaniſhing Line VL, then D is its Center, and DE its Diſtance.

To apply this to Practice.—Imagine the ſeveral Planes to be laid down as before.

Fig. 71. Then, HL is the Horizontal Line, E the Eye, C the Center of the Picture, CE its Diſtance, HV the vaniſhing Line of the perpendicular Plane t y x, VL the vaniſhing Line of the oblique Plane t o z y, C its Center, CE its Diſtance, and H, L, V, the vaniſhing Points of the ſeveral Planes; or, if you pleaſe, of the ſeveral Sides of ſuch a Figure.

Let t o, be given for the neareſt Side. Continue t o, 'till it cuts the vaniſhing Line HL in its proper vaniſhing Point L: From L draw L𝕮, and from t and o, draw Lines to their vaniſhing Point V, and draw V𝕮: Then is V𝕮L a right Angle; which biſect, and draw E𝕯, cutting the vaniſhing Line VL, in 𝕯; then is 𝕯 the vaniſhing Point of the Diagonal of a Square: Therefore (ſince the inclined Plane was ſuppoſed to be a Square) draw 𝕯t, cutting oV in z; from L, through the Point z, draw L z y, cutting tV in y; then draw y z, parallel to HV, which will compleat the whole Repreſentation, not only of the inclined ſquare Plane, but the whole Appearance of a Figure like Fig. 65, 67, but in a different Situation.

Since this Figure is as difficult in regard to the Practice of Perſpective, as any I can think of, I have annexed the Paper Planes in the 72d Figure, to help the Reader's Reflections upon it; and to aſſiſt him ſtill further, we will now find the Repreſentation of ſuch an Object without any Regard to the Theory.

Let E be the Eye, C the Center of the Picture, CE its Diſtance, HL the horizontal Line, and t o one Side given of the inclined Face. Fig. 71.

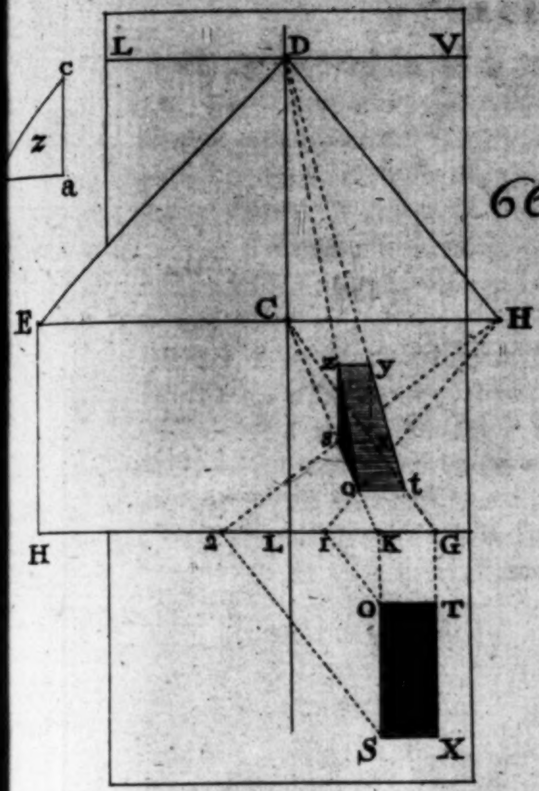
Any where apart draw AB, Fig. X. parallel to the horizontal Line HL, and draw CB perpendicular to AB; then make an Angle at A, equal to the Angle of Inclination (as TYX in Fig. 70.) and draw AC.---Continue t o, to its vaniſhing Point L, and from L draw LE to the Eye; then at E make a right Angle with the Line LE, and then, becauſe the Side which lies upon the Ground is a Square, therefore H is the vaniſhing Point of the two Sides t x and o s, and L is the vaniſhing Point of the two other Sides t o and s x. ---From the vaniſhing Point H, draw HV perpendicular to the horizontal Line, and continue the horizontal Line towards ℑ. From H ſet off Hℑ, equal to the Diſtance HE of the vaniſhing Line HV; then from ℑ draw ℑV, parallel to AC in Fig. X; which will cut HV in V, and give HV for the vaniſhing Line of the perpendicular Plane t y x; and by drawing a Line through the Points V and L, we ſhall have VL for the vaniſhing Line of the inclined Plane t o z y: Therefore from the Center C of the Picture, draw Cℭ, perpendicular to the vaniſhing Line VL, and continue it at pleaſure; then is ℭ the Center of that vaniſhing Line. Again, from the Center of the Picture C, draw CI perpendicular to Cℭ, and make CI equal to CE, the principal Diſtance, and then draw Iℭ, which is the Diſtance of the vaniſhing Line VL; therefore, make ℭ𝔈 equal to ℭI, and from the vaniſhing Points V and L, draw V𝔈, L𝔈, which will be a right Angle: Biſect the Angle 𝔈, and draw 𝔈𝔇, cutting the vaniſhing Line in 𝔇; then, as before, 𝔇 is the vaniſhing Point of the Diagonal of a Square t o z y, from whence the whole Repreſentation may be compleated. Here alſo the Learner is referred for Examples to Book II. Chap. 2. Sect. 4.

Thus have I endeavoured to explain the Theory of Perſpective, and to apply it to Practice by the moſt familiar and uſeful Examples, and in all the Variety of Inſtances which can come within the general Practice of Painting, &c. As for other Matters, which are out of the common Road, and which ſerve rather to perplex than benefit a Learner, I have purpoſely avoided them;

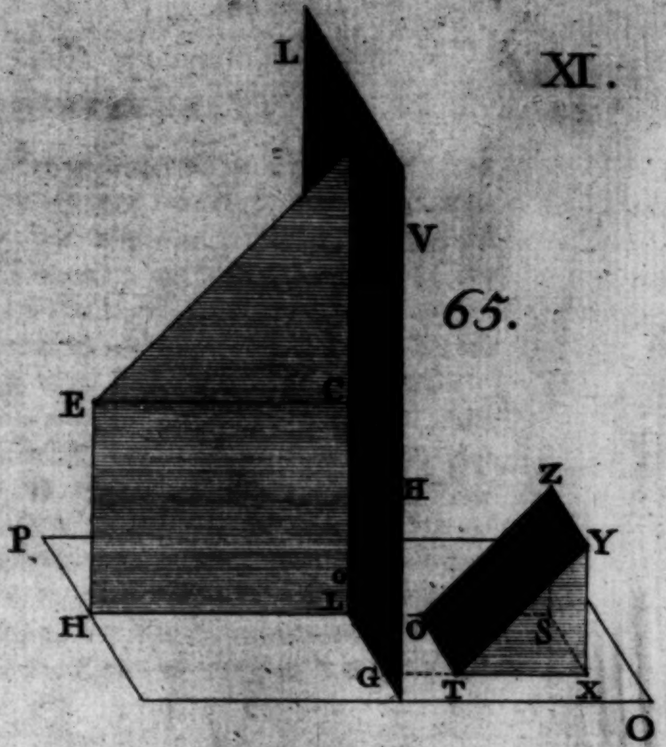
and

and believe, I may venture to affirm, that whoever has attended to what has been ſaid, and exerciſed himſelf regularly with the Examples to which he was referred in the Practical Part, Book the Second, will find no kind of Difficulty in determining the Appearances of any Objects upon an upright Picture, let them be of ever ſo irregular a Figure, or howſoever they are ſituated.

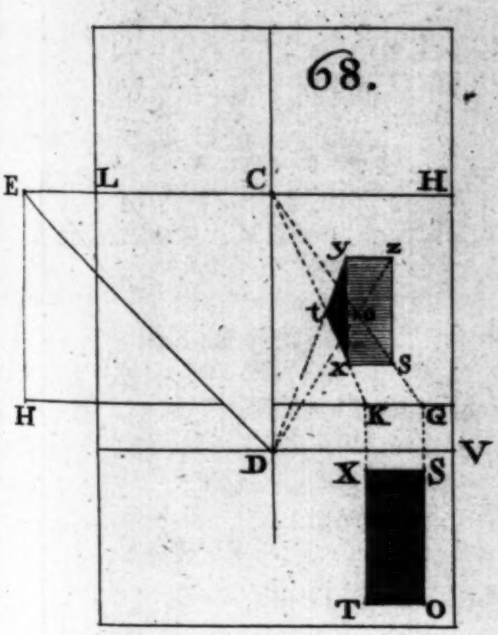
But thus far I have confined myſelf to the Appearance of Objects upon an upright Picture only, ſuch as are generally made choice of for Perſpective Repreſentations: But as there are ſome Caſes in which the Situation of the Picture is different, ſuch as Ceilings, inclined Walls, or the like, I ſhall now proceed to the Conſideration thereof, and ſhew, that the Repreſentation of Objects upon ſuch kind of Surfaces, is deducible from the ſame Principles, and conſequently, is to be determined after the ſame Manner; which is the Subject of the next Chapter.


c
z
a
L
D
V
E
C
H
z
y
s
x
o
t
H
2
L
f
K
G
O
T
S
X

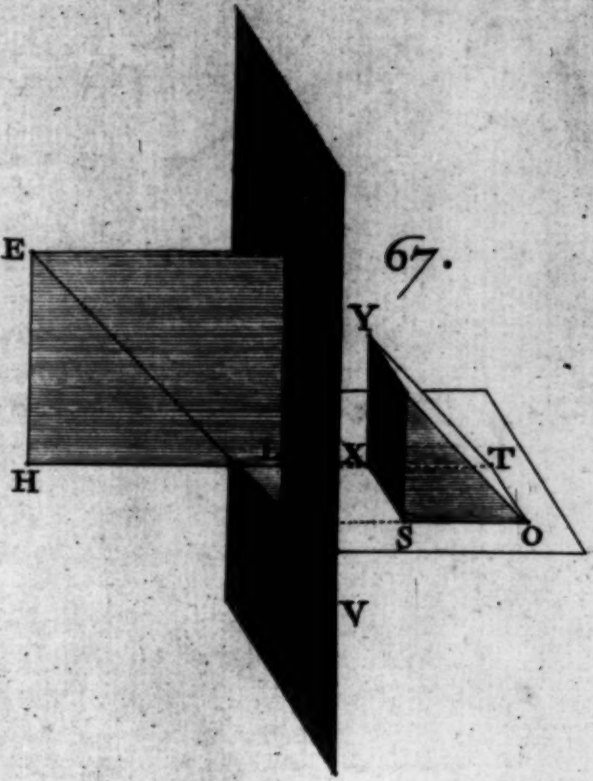
66.


L
V
E
C
H
P
Z
Y
o
L
H
O
S
G
T
X
O

65.


E
L
C
H
y
z
t
o
x
s
H
K
G
D
V
X
S
T
O

68.

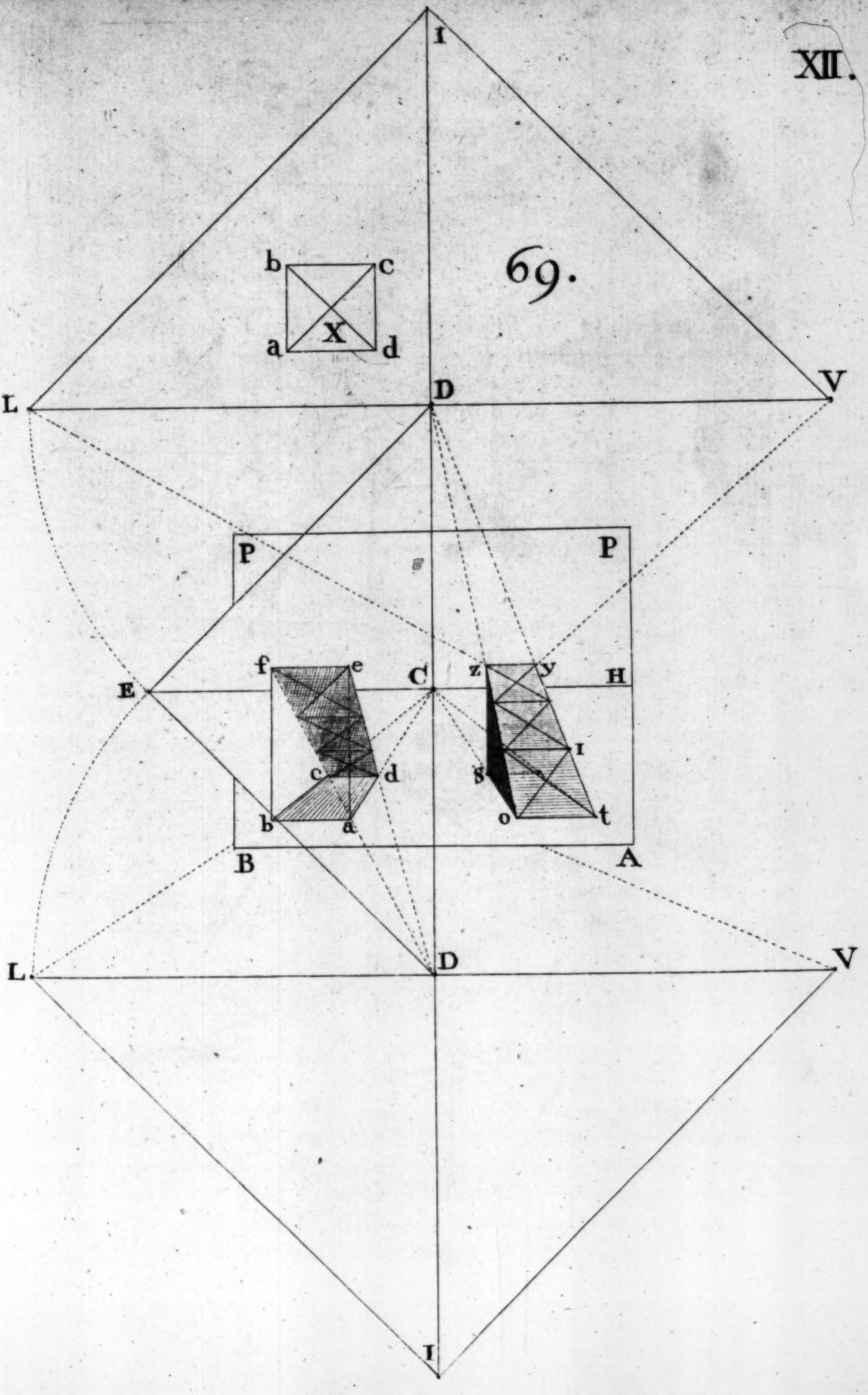

E
Y
H
L
X
T
S
O
V

67.

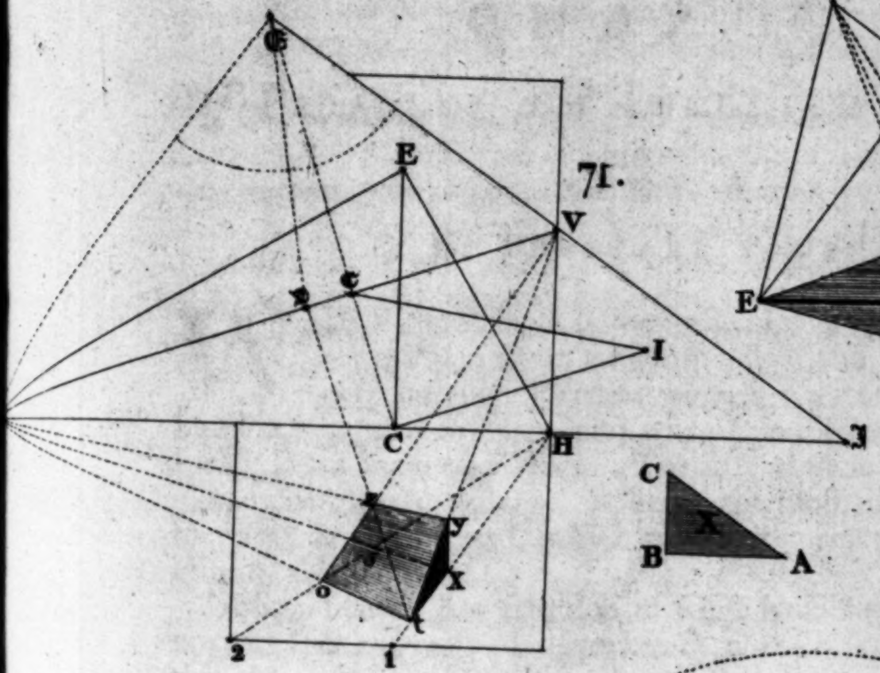
BRITISH 1 JY64 MUSEUM

XII.

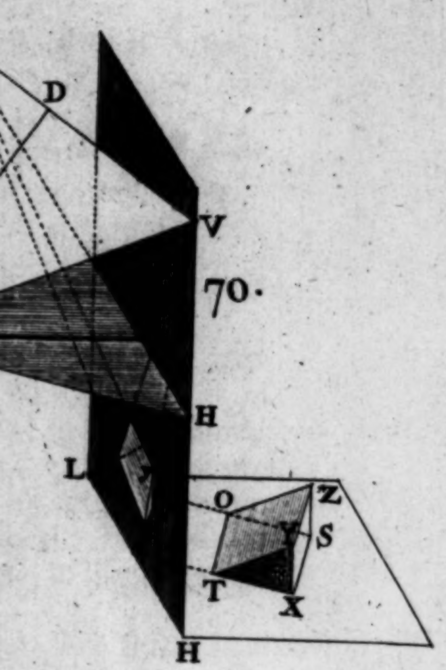
69.



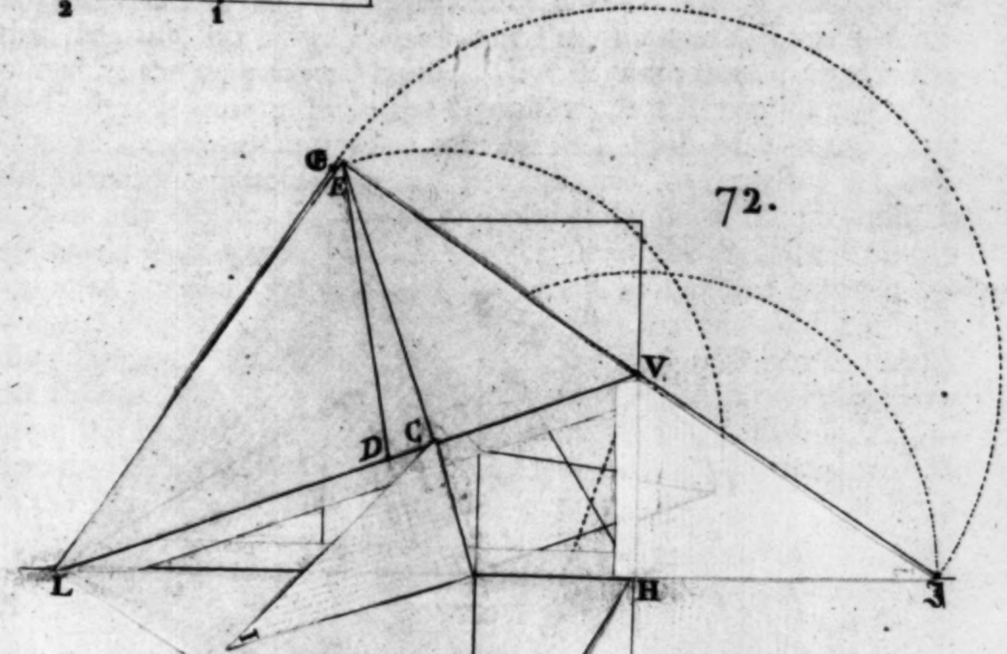
BRITISH 1 JY64 MUSEUM



71.



70.



72.

BRITISH
1 JY64
MUSEUM

CHAP. IV.

Of PARALLEL *and* INCLINED PICTURES.

SECT. I.

Of the PARALLEL PICTURE.

WHEN the Picture is perpendicular to the Ground, or any other Plane upon which the Spectator ſtands, I call it a perpendicular Picture; when it is parallel to the Ground, I call it a parallel Picture; and when it is inclined to the Ground, I call it an inclined Picture. The firſt of theſe Situations I have already conſidered at large, as being the moſt uſeful: Proceed we therefore to the Second, which principally relates to Ceilings or immoveable Pictures.

Now, whoever has attended to what hath been ſaid upon the upright Picture, will (I apprehend) find no ſort of Intricacy in this, becauſe, on either Picture, the Projection of Objects is determined in the very ſame Manner. But if there ſhould appear any Difficulty, it cannot be in the Operation, but in conſidering what Objects are proper and what not for ſuch kind of Pictures; and the Situation of thoſe Objects. For inſtance, to repreſent a Landſkip or any Objects which are ſuppoſed to be upon the Ground, is extremely improper for a Ceiling; for ſince the Picture is always ſuppoſed parallel to the Ground, and the Eye is placed between the original Object and the Picture, therefore the Rays of Light in their Paſſage from original Objects to the Eye, will not be cut by the Picture, and conſequently ſuch Objects can have no Projections upon the Picture; for which Reaſon they ought not to be repreſented. But any Objects which may reaſonably be ſuppoſed to exiſt in the Air, or any Story which can be ſupported either by Hiſtory or Fable, may be repreſented with the greateſt Propriety; as may likewiſe ſeveral Parts of Architecture, which may ſerve either for Ornament, or be uſeful as to the main Deſign. And in regard to the Situation of Objects, they are generally ſuppoſed to be erect, and therefore I ſhall principally conſider them in that Situation; which will be ſufficient for our Purpoſe, as it will give the Reader a very clear Idea of all that can be ſaid upon the Subject; and which, together with the Examples under this Head in the Second

Book, will enable him to find the Repreſentation of all Objects upon a Ceiling with the ſame Facility as he can determine thoſe upon an upright Picture.

Fig. 73. Let KMNO be the Ground, E the Eye, EH its Height, OGLP the Picture, (which we will ſuppoſe a Ceiling) C the Center of the Picture, CE its Diſtance, and GACL a Plane perpendicular to the Picture whoſe Repreſentation is required.

From the Section GL, draw GC, LC; then from A and C draw AE, CE, cutting GC, LC, in a and c; then draw a c, which will compleat the Repreſentation G a c L, of the original GACL; and will to an Eye placed in E, appear to be erect.

Let us now turn the Figure in ſuch a Manner that the Picture may become an upright one; then ACMK is the Ground Plane, E the Eye, EC its Diſtance, EI its Height, C the Center of the Picture, VL the horizontal Line, and G a c L the Repreſentation of GACL, which lies upon the Ground. From hence then it is evident, that in order to determine the Appearance of any perpendicular Plane upon the parallel Picture, we muſt proceed in the very ſame Manner as in finding the Repreſentation of an Object which lies flat upon the Ground in the perpendicular Picture; for in both Caſes, the original Plane ACLG is perpendicular to the Picture, only the Situation of the Picture is different in regard to the Eye, and therefore the Repreſentation in both Caſes will be the ſame, as is manifeſt by inſpecting the Figure.

But ſuppoſe the original Plane be parallel to the Picture; then the Repreſentation will be like the Original, and muſt be found by the ſame Rules as Objects thus ſituated are determined upon the perpendicular Picture.

Fig. 75. Thus, let LGPO be the Picture, E the Eye, C the Center, and CE its Diſtance, and ABCD the original Plane parallel to the Picture.

From A, B, C, D, draw Lines perpendicular to the Picture, interſecting it in the Points G, L, P, O; then from thoſe Points draw Lines to the Center of the Picture; and from the Points A, B, C, D, draw Lines to E, which will interſect GC, LC, PC, and OC, in a, b, c, d, and thereby determine the Repreſentation required.

Now let us turn this Figure alſo, and call ABMK the Ground Plane; then this Picture is an upright one, and the Repreſentation a b c d, of the parallel Plane ABCD, in either Situation of the Picture is the ſame, and conſequently the Repreſentation of all parallel Objects are to be determined after the ſame Manner as in the upright Picture.

Now, ſince the Rules for drawing the Appearance of Objects upon the parallel Picture, are exactly the ſame as thoſe for drawing the Appearance of Objects upon the perpendicular Picture, it follows, that the ſame Rules will do in both Caſes, and therefore the Artiſt has nothing more to remember than this, *viz.* thoſe Objects which in the parallel Picture are to be repreſented as erect, muſt be determined as thoſe which lye flat upon the Ground in the perpendicular Picture; thoſe which are parallel in one Picture, as thoſe which are parallel in the other; and thoſe which are oblique, after the ſame Manner: Or in other Words, however original Planes are ſituated, the Repreſentation of thoſe Planes muſt always be determined by imagining a Plane to paſs through the Eye parallel to thoſe Planes, which will give the vaniſhing Line of thoſe Planes, and from which the whole Repreſentation may be compleated. Thus, the Plane FGVL, which paſſes through the Eye E, parallel to the original Plane ACLG, produces the vaniſhing Line VL of that Plane; and therefore having the Diſtance EC of that vaniſhing Line, the Repreſentation of any Lines which can be drawn in the original Plane are eaſily found alſo. Fig. 73.

And here we may obſerve, that if the original Plane ACLG, was infinitely extended, the Triangle GLC, would be its indefinite Repreſentation, and conſequently the Appearance of all Lines which can be drawn in that original Plane, will be ſomewhere within that Triangle. And ſo likewiſe, if perpendicular Planes are erected on the other Sides LP, PD, DG, of the Picture, their indefinite Repreſentations will be the ſeveral Triangles LCP, PCD, and DCG, and the Center C will be their common vaniſhing Point.

For draw the original Plane ACLG upon the Side LG of the Picture, and let every thing elſe remain as in the former Figure. ---Through E draw the Plane FHGLV, parallel to the Plane ACLG, which will cut the Picture in VL; then is VL the vaniſhing Line of that Plane. Again, from E draw EC, perpendicular to VL; then is C the Center of the Picture. And ſince EC is parallel to AG, BS and CL, therefore C is the vaniſhing Point of thoſe Lines; and therefore, from C, the Center of the Picture, draw Lines to G, S, L; and from A, B, C, draw Lines to E, which will cut the former Lines in the Points a, b, c; then is aG the Repreſentation of AG, bS of BS, and cL of CL; and GacL is the whole Repreſentation of the original Plane ACLG. Fig. 74.

And after the ſame Manner any other Lines, as xz, may be found upon the Picture.

And from hence alſo, we may obſerve, that if perpendicular Planes are ſet on each Side of the Picture, the Repreſentation of thoſe Planes will appear like the Sides of a Room continued upwards; from whence it follows, that by ſuch Deceptions as this, a Room may be made to appear of any Height, by drawing a Repreſentation of this Kind upon a Ceiling with Accuracy and Judgment, and viewing it from the proper Point. One Example of which I ſhall give in this Place, by way of Practice, and then refer the Reader again to the ſecond Book for more Examples of this Sort.

Fig. 76. Let GLPO be a Ceiling, E the Eye, EC its Diſtance, and C the Center of the Picture.

Through the Center C draw Lines parallel to LP, LG, and continue them at pleaſure; then with the Diſtance CE deſcribe a Circle, cutting thoſe Lines in D, F, H: Then DCH is the vaniſhing Line for the original Planes, which ſtand upon the Sides GL and OP; and ECF is the vaniſhing Line of the Planes which ſtand upon the Sides GO and LP; and the ſeveral Lines EC, DC, FC and HC, are the Diſtance of the Eye from thoſe Lines. Having ſettled the vaniſhing Lines of the four Sides, their Center and Diſtance, it matters not upon which Side we begin to work; for upon any Side, as GL, draw out one of the original Planes, as ACLG, and upon it draw the Lines Xz, BS, which will make it like the Plane ACLG, Fig. 74. From the ſeveral Sections G, S, L, draw Lines to C; and from A, B, C, draw Lines to E, cutting GC, SC, LC, in the Points a, b, c; then from a and c draw ac, and then will Ga be the Repreſentation of GA, Sb of Sb, and Lc of LC: Therefore, GacL is the Repreſentation of the whole original Plane GACL, and the Triangle GCL is the Repreſentation of that Plane infinitely extended.—In like Manner xz is the Repreſentation of its Original XZ.

Or the Operation may be ſhortned thus. From the extreme Point B of any Perpendicular in the original Plane, draw a Line, BI, at pleaſure, cutting the Section in I; then from E draw EK parallel thereto, cutting the vaniſhing Line DH in K; from the Section S, of the Perpendicular SB, draw SC; and from the Section I draw IK, cutting SB in b: Then is bS the Depth of the Repreſentation; therefore, by drawing GC, LC, and by drawing a Line through b, parallel to GL, the Thing propoſed is done.

Now, in order to tranſfer this Repreſentation unto all the other Sides, proceed thus.

From O and P draw Lines to the Center C; then will the remaining Part of the Ceiling be divided into three Triangles, GCO, OCP, PCL; which Triangles may repreſent three Planes perpendicular to the Ceiling, infinitely extended, and at right Angles with each other; and GC, OC, PC, and LC, repreſent the joining of thoſe Planes: For GC and LC are the Repreſentations of GA and LC infinitely extended; and therefore, having found the Depth (as Ga) of the Repreſentation of any given Plane, as above, from the Point a, which determines that Depth, draw a Line, as ae, parallel to OG; and from e, where ae cuts OC, draw another Line ed parallel to OP; and from d, where ed cuts PC, draw dc, which will cut LC in c; then will GaeO, OedP, and PdcL, be the Repreſentations of three perpendicular Planes of the ſame Height as ACLG, and ſituated in the ſame Manner; that is, upon the ſeveral Sides GO, OP, and PL; and conſequently, to an Eye placed at the Diſtance EC, the Sides of a Room will appear to be continued above the Ceiling by the Length of the Perpendicular GA, *i.e.* the Height of the original Plane ACLG.

SECT. II.

Of the INCLINED PICTURE.

I Have before obſerved, that by an inclined Picture, I would be underſtood to mean when the Perſpective Plane is neither perpendicular nor parallel to the Ground, but inclined to it. Indeed, this Situation of the Picture is very ſeldom made uſe of; yet as there are ſome Caſes which may require the Knowledge of this kind of Perſpective, I have therefore given it a Place in this Work.

Let HOP be the Ground or original Plane, HLGL the Picture, inclin'd to the Ground Plane at the Angle PLL; and let E be the Eye, EH its Height, and H its Seat upon the Ground. Fig. 77.

Continue the Picture HLGL downwards at Pleaſure, as GLFO. From the Seat H of the Eye draw HS perpendicular to the Section GL, cutting GL in S; then through S, draw SD perpendicular to GL alſo, and continue it at pleaſure towards FO; and then from E, draw ED parallel to HS, cutting the Picture in D, and continue EH 'till it cuts DS in V; then from V, draw VI parallel to ED, and from D, draw DI parallel to EV: And then will EDIV be a

Plane which paſſes through the Eye perpendicular to the Ground Plane HOP, interſecting the Picture in the Line DV; and therefore the Section DV will be the vaniſhing Line of all Planes that are perpendicular to the Ground Plane and parallel to the Plane EDIV; and for the ſame Reaſon, V will be the vaniſhing Point of all Lines that are perpendicular to the Ground Plane HOP, becauſe EV which is drawn through the Eye parallel to thoſe Lines, will cut the Picture in the Point V: For as in the upright, or parallel Picture, ſo alſo in this, the vaniſhing Line of any original Plane muſt be determined, by imagining a Plane to paſs through the Eye parallel to that original Plane 'till it cuts the Picture. And ſo alſo in regard to the Center and Diſtance of the Picture, or the Center and Diſtance of a vaniſhing Line; the firſt is found by drawing a Line from the Eye, as EC, perpendicular to the Picture, and the latter, by drawing a Line from the Eye, as ED, perpendicular to that vaniſhing Line: The Method for doing either is as follows:

1. *For the Center and Diſtance of the Picture.*

Having continued the Picture downwards as above directed, and drawn the vertical Plane EDIV; from E, draw EC, perpendicular to the Section DV; then will C be the Center of the Picture, and CE its Diſtance: For ſince the vertical Plane cuts the Picture at right Angles, and ſince EC is in that Plane, and perpendicular to the Section DV, therefore EC is perpendicular to the Picture alſo, and conſequently C is the Center of the Picture, and CE its Diſtance.

2. *For the Center and Diſtance of a vaniſhing Line.*

Let the Plane ABHL paſs through the Eye E, parallel to the Ground Plane HOP, and it will cut the Picture in HL, which Line HL is the vaniſhing Line of the original Plane HOP; and if from E, a Line, as ED, be drawn perpendicular to HL, then D, where it cuts HL, is the Center of that vaniſhing Line, and DE is its Diſtance.

Fig. 78. Now, let it be required to find the Repreſentation of the original Plane ABGL upon the inclin'd Picture GLHL; and let E be the Eye, H its Seat upon the original Plane, EC its Diſtance, and C the Center of the Picture.

From the Seat H of the Eye, draw HS, perpendicular to the Section GL; from S, draw SD perpendicular to GL, and continue it at pleaſure; then from the Eye E, draw ED parallel to HS, cutting SD in D; finally, through D, draw HL, parallel to

GL, then is HL the vaniſhing Line of the original Plane ABGL, and D is the vaniſhing Point of the Sides AG, BL; therefore, from G and L draw GD, LD, and from A and B draw AE, BE, cutting GD, LD, in the Points a and b; then is G a b L the Repreſentation of the original Plane GABL.

To apply this to Practice.—Let GLNM be the Picture laid Fig. 80. flat, as in ſome of the preceding Figures.—Biſect the Bottom GL, and draw cD perpendicular thereto, and continue it at pleaſure: Then from the 78th Figure take SC, CD, and tranſfer them unto cD in this Figure, beginning at the Point c; draw HL; then is C the Center of the Picture, c D the Height of the vaniſhing Line, and D its Center. Again, make D₵ equal to the Diſtance of the Eye, and AG equal to the Length of the original Plane, (that is, equal to AG Fig. 78.) then from G and L draw GD, LD, and from A draw A₵, cutting GD in a; finally, from a draw a b, parallel to GL, which will compleat a Repreſentation G a b L, exactly like G a b L Fig. 78.

Or it may be done thus.—From the Center C draw CE, parallel to GL, and make CE equal to the Diſtance of the Picture, and ED equal to the Diſtance of the vaniſhing Line HL; then from D, with the Radius DE, deſcribe the Arc EL₵H; and from G, with the Radius GA, deſcribe the Arc Ac; and then from c and H draw Hc, which will cut GD in a, and give the Depth of the Repreſentation; from whence the whole may be compleated.

In like Manner, let it be demanded to find the Projection of a Fig. 79. Line AB, which ſtands perpendicular to the Ground Plane HOP.

From B, the Seat of the Line AB, draw a Line BH to the Seat of the Eye H; and from V draw V d, through the Section C, and continue it at pleaſure; then from A and B draw Lines to the Eye E, cutting V d in a and b; and then is a b the Repreſentation of the Original AB. For ſince EV is parallel to the Original AB, therefore the Point V, where it cuts the Picture, is the vaniſhing Point of AB, and of all other Lines which are parallel to AB: And if we imagine a Plane ABHE to paſs through the original AB, and the Line HE, it will cut the Picture in c a; and therefore, ſince the original Rays AE and BE are in that Plane, the Section a b will be the Repreſentation of AB.

To apply this to Practice.—Let MNGL be the Picture, laid Fig. 81. flat as before. Then C is its Center, CE its Diſtance, V the vaniſhing Point of Lines perpendicular to the Ground Plane, HL the vaniſhing Line of Planes parallel to the Ground Plane, D the

H Center

Center of that vaniſhing Line, and DE its Diſtance. Now, let it be required to find the Repreſentation of a ſquare Plane which ſtands perpendicular to the Ground Plane, having one Side, a b, of the Repreſentation given.

From D, the Center of the vaniſhing Line HL, and with the Diſtance DE, deſcribe an Arc ELFH, cutting the vaniſhing Line in H and L; then is H the vaniſhing Point of the Sides a d, b c: Therefore, draw a H, b H, and from H draw HV; ſo will HV be the vaniſhing Line of a Plane perpendicular to the Ground; and by finding A, (the vaniſhing Point of the Diagonal of a Square) the whole Repreſentation may be determined.

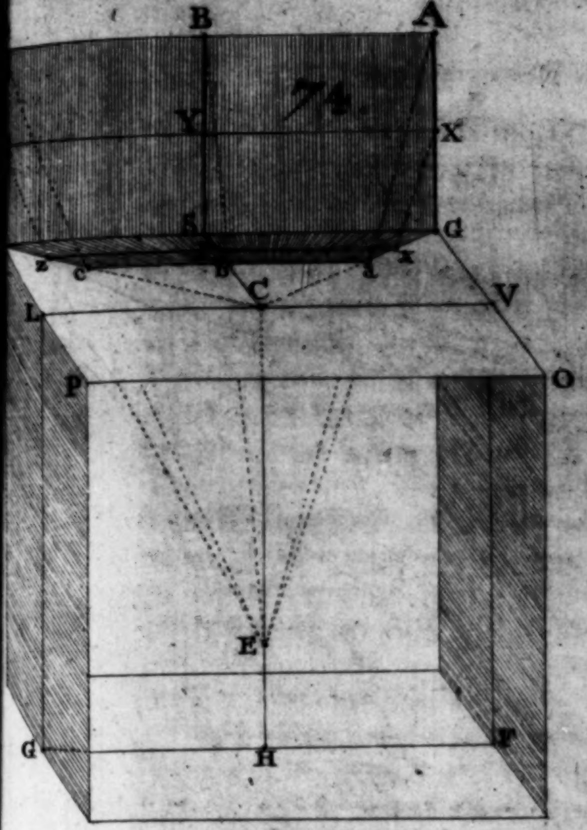
The 82d Figure repreſents a Cube upon the inclined Picture: For having determined the Appearance of one Face a b c d, as in the laſt Figure, the whole Repreſentation may be compleated, by means of the vaniſhing Lines HL, HV, and LV, and the vaniſhing Points of the Diagonals, B, D, G.

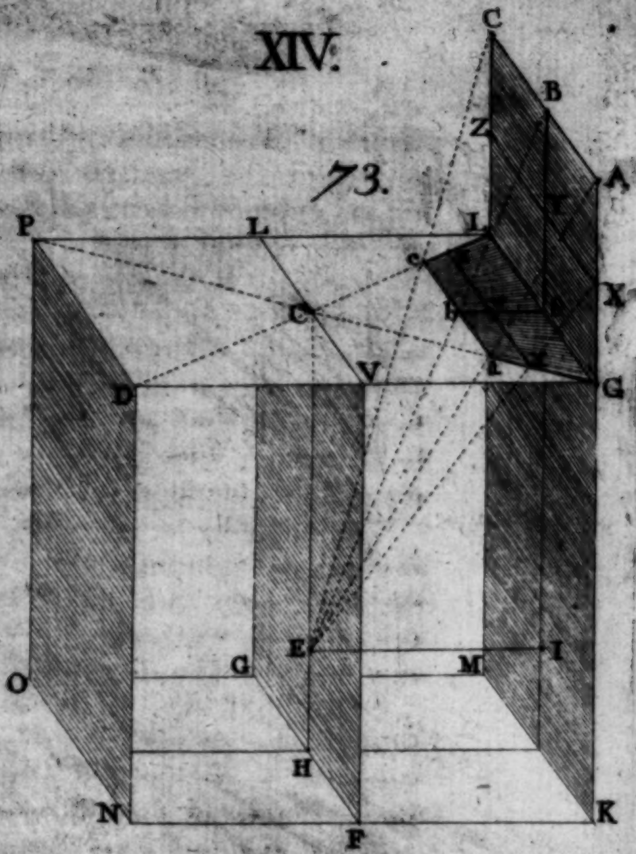
I have hitherto conſider'd the Picture as reclined to the Eye; let us now ſuppoſe it to be inclined to the Eye, as in Fig. 83, where E is the Eye, LV the Picture, C its Center, CE its Diſtance, V the vaniſhing Point of Lines perpendicular to the Ground, and DL the vaniſhing Line of Planes parallel to the Ground.— In the 84th Figure the Picture is laid flat, and the Repreſentation of one Face of a Cube is determined: And in the 85th Figure, the Projection of the whole Cube is compleated.---Theſe Figures need no Explanation, being only as it were the Reverſe of the others; and therefore a little Attention muſt render them extremely obvious.

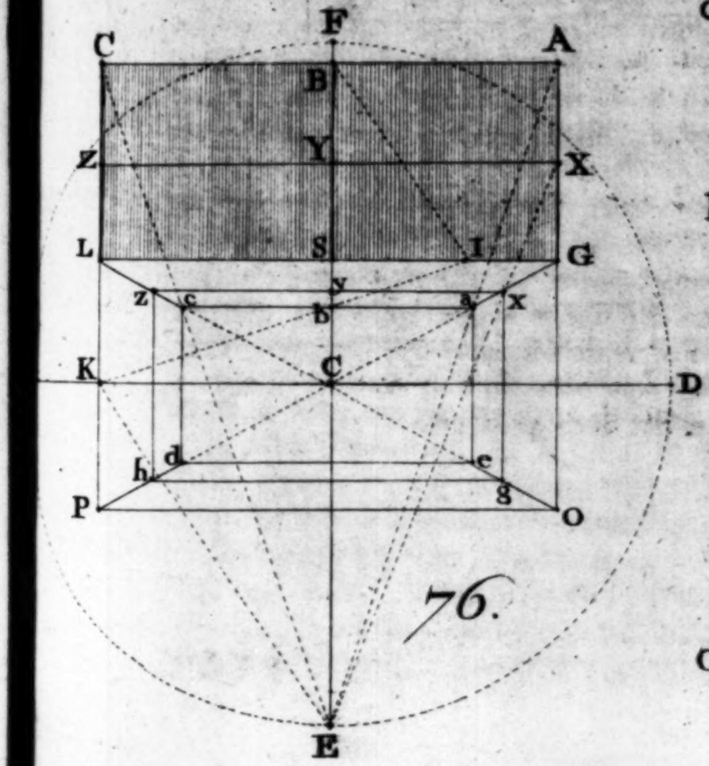
From hence then it follows, that the Method of determining the Repreſentation of a Cube upon an inclined Picture, is exactly the ſame as in finding the Appearance of a Cube any ways inclined to the Ground; and therefore the Rules which ſerve for the one will ſerve for the other alſo: For which Reaſon the Learner, is deſired to compare this with what has been ſaid in Sect. 5, Chap. 3, and with the Practical Part in the Second Book.

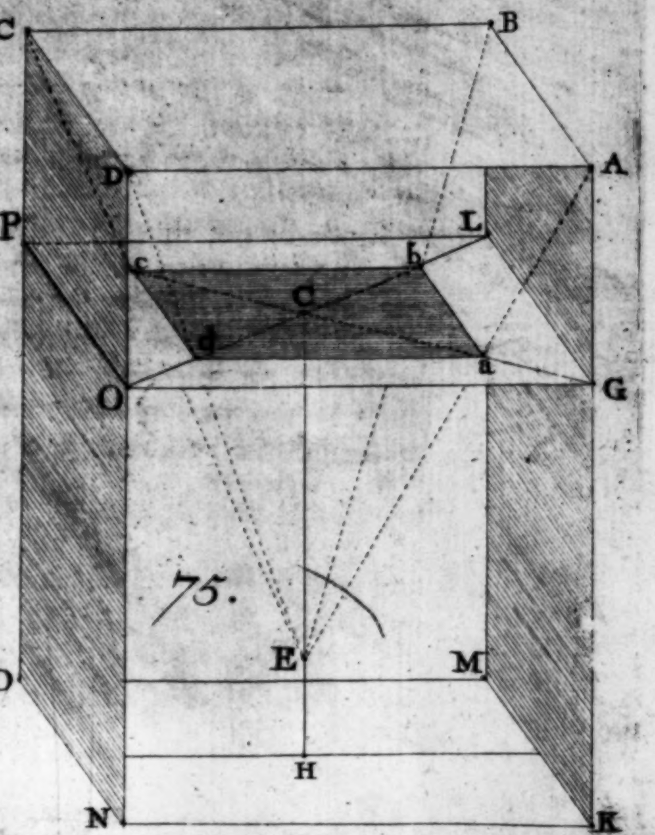
SECT.

XIV.

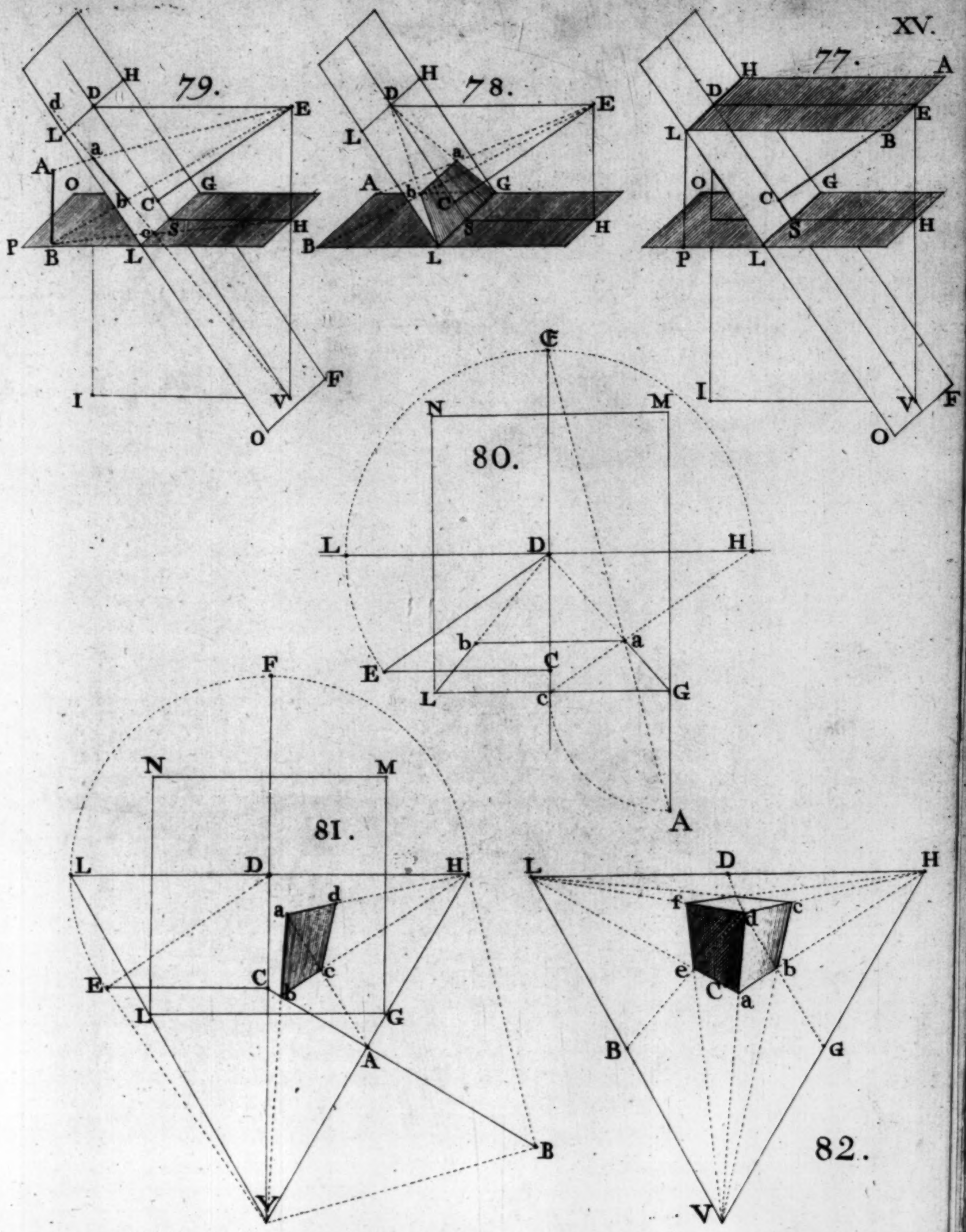

74.


73.


76.

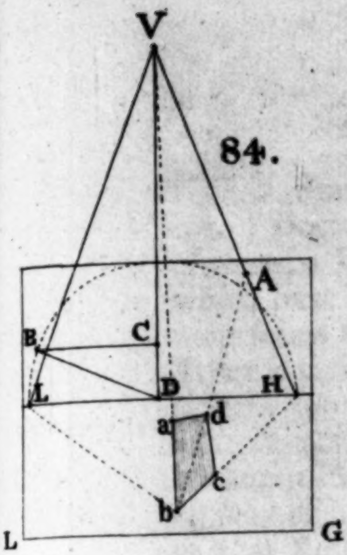

75.

BRITISH
1 JY64
MUSEUM



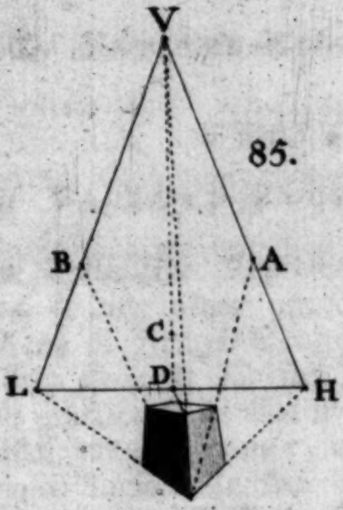
79. 78. 77. 80. 81. 82.

BRITISH
1 JY64
MUSEUM



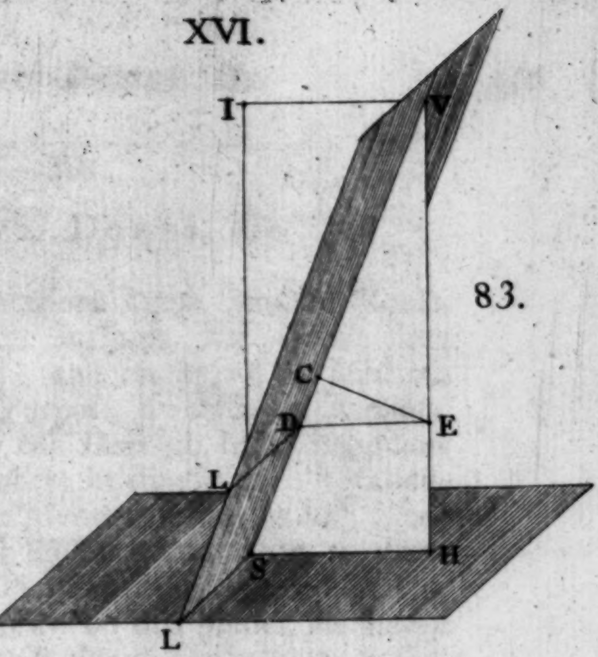
84.

V
A
B
C
L
D
H
a
d
c
b
L
G



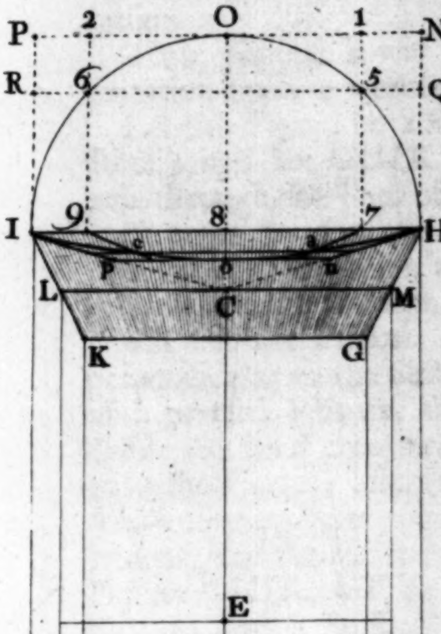
85.

V
B
A
C
L
D
H



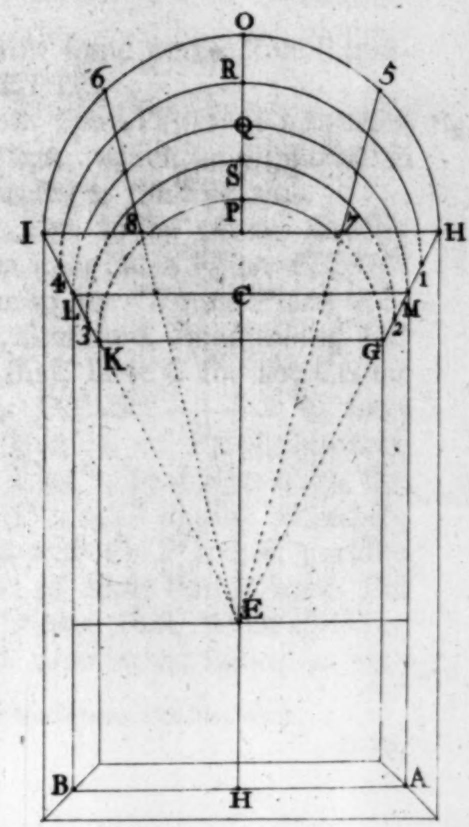
83.

I
V
C
E
D
L
S
H
L



87.

P
2
O
1
N
R
6
5
Q
I
9
8
7
H
L
C
M
K
G
E
B
H
A



86.

O
6
R
5
Q
S
P
I
8
7
H
4
1
L
C
M
3
K
G
2
E
B
H
A

BRITISH
1 JY64
MUSEUM

SECT. III.

Of Vaulted Roofs, Domes, *&c.*

TO draw Perſpective Repreſentations upon vaulted Roofs, Domes, or any other uneven Surfaces, has always been eſteemed a Work of great Difficulty; and among all the Methods which have been given us for this Purpoſe, by different Authors, none ſeems ſo practicable as that by Mr. *Hamilton*, in his ingenious Treatiſe intitled Stereography; where he directs us to * Reticulate the propoſed Surface, in ſuch a Manner as may be beſt ſuited to its Shape, and can with the moſt Eaſe be done; then to draw out, on a Plane properly choſen, a Picture of the intended Deſign, by way of Model; after which, to draw on this Model, the Image of that Reticulation, by the common Rules of Perſpective; which will divide the Deſign on the Model, into ſuch Parts, as are proper to be transferred into each correſponding Cell of the original Reticulation; and finally, by means of this Reticulation, to transfer the Work unto the Dome or Roof, in the ſame manner as one Picture is copied from another, by the common Methods of Reticulation.

Thus, ſuppoſe it was required to paint ſome perſpective Repreſentation upon a vaulted Roof, HOIKPG.

Let this Figure be a Model drawn out upon Paper, of a vaulted Roof; and let GHIK repreſent a Plane, which is ſuppoſed to paſs through the Foot of the Arch, parallel to the Horizon. Fig. 86.

Now, if we ſuppoſe the Spectator's Eye to be placed directly under the Middle of it at E, and then imagine a Plane ABLOM to paſs through the Eye, perpendicular to the Ground Plane AB, it will cut the Picture in ML; and therefore, by drawing EC perpendicular to the Section ML, we ſhall have C for the Center of a parallel Picture, and CE for its Diſtance.——Let us next divide the Roof into any Number of Squares, or Parallelograms, as in the Figure; and then imagine a Line to be drawn from the Angle of every Square to the Eye E; and it muſt appear extremely evident, that the Sections of theſe Lines with the Plane, or parallel Picture GHIK, will be the Projection of thoſe Points upon the Picture; and it muſt alſo appear as obvious, that, when the Projection of the Angle of every Square is determined upon the Picture,

---

* To Reticulate any Surface, is to divide it into Squares like Net-Work.

ture, the whole Repreſentation of thoſe Squares may eaſily be compleated. But farther, ſince the perpendicular Plane ABLQM paſſes through the Eye, and cuts the Picture in a ſtrait Line; therefore the Projection MCL, of the Arch MQL, will be a ſtrait Line upon the Picture; but the Projection of all the other Arches, 1R4, HOI, *&c.* will be curve Lines. Again, ſince the tranſverſe ſtrait Lines 7 5, PO, 6 8, are parallel amongſt themſelves, and are alſo parallel to the Picture; therefore the Repreſentation of thoſe Lines upon the Picture, will be ſtrait Lines, and parallel to each other.

Theſe Things being premiſed, let us now ſuppoſe this Figure removed to the 87th Figure.----About the Arch HOI, deſcribe the Parallelogram HIPN; and through the Points 5, O, 6, draw the Lines 1 7, O8, 2 9, perpendicular to the Picture, and cutting the Picture in the Points 7, 8, 9; then through 5, 6, draw QR parallel to HI, and from the ſeveral Sections H, 7, 8, 9, I, draw Lines to C, and from N, O, P, Q, R, draw Lines to the Eye E, which will determine the Projection of the Parallelogram; by which means the Repreſentation H a o c I, of the Arch HOI, may be compleated. After the ſame Manner, the Projection of all the other Arches may be found; but as one is ſufficient for our Purpoſe, we will now ſuppoſe this parallel Picture to be laid down flat in the 89th Figure, where C is the Center, CE the Diſtance of the Picture, and H, 7, 8, 9, I, the Sections of the Perpendiculars NH, 1 7, *&c.* in Fig. 87.

Continue IH (Fig. 89.) at pleaſure, towards N, and make HQN in this Figure equal to HQN in the 87th Figure; then from H, 7, 8, 9, I, draw Lines to C, and from N and Q draw Lines to E, which will cut HC in n and t, and give the Depth of the Parallelogram HnpI; by which Means the Points H, a, o, c, I, will be determined: Which being ſo many Points in the Repreſentation of the Curve, they will be a ſufficient Guide for drawing it, as in the Figure. After the ſame Manner, the Repreſentation of the other front Arch is to be found: From whence it follows, that the Projection of the whole curved Roof upon this parallel Picture, will be contained within the two curved Lines HoI, GgK, and the two ſtrait Lines GH and IK; and therefore GHoIKg is the whole Space allotted for the Deſign. Now having determined this Space, let us next find the Projection of the ſeveral Squares which were ſuppoſed to be drawn upon the original Roof.

From a, o, c, draw Lines parallel to the Side GH, or IK; then will af, og, cd, be the Projections of the tranſverſe Diviſions (or ſtrait Lines) which are parallel to the Picture; and by dividing the ſeveral Lines HG, af, og, cd, and IK, into four equal Parts, we have the Points given, through which the other Curve Lines are to be drawn, as in Fig. 88; by which Means the whole Repreſentation may be compleated.

If it be required to paint any Perſpective Repreſentation upon a Dome, that alſo may be done after the ſame Manner; *viz.* by imagining the Dome to be divided into ſeveral perpendicular Sections, drawn at equal Diſtances from the Baſe, through the Center of the Dome; and then ſuppoſing thoſe Sections to be cut by other Sections, which are made by Planes that are ſuppoſed to paſs through the Dome parallel to the Horizon; then by making a Model upon Paper in a given Proportion, and taking the Diſtance of the Eye accordingly, we may find the Projection of thoſe Sections upon the parallel Plane, as in the former Figures: For then we ſhall have a parallel Picture, which we ſuppoſe paſſes under the Bottom of the Dome, properly reticulated, and by that Means, whatever is drawn upon it, may be transferr'd unto the real Dome or Cupola.

Thus, let ABDE, Fig. 90, repreſent the circular Plane (or parallel Picture) which we ſuppoſe to lie under the Bottom of the Dome; and let AacegfdbB, Fig. 91, repreſent one of the perpendicular Sections above-mention'd; and let us imagine the Dome to be divided perpendicularly by four of theſe Planes, and horizontally by four Planes, the Sections of which horizontal Planes are expreſſed by AB, ab, cd, ef: Then let us divide the Circumference of the Plane, or Picture, ABDE, Fig. 90, into eight equal Parts, and from each Part draw Lines through the Center C; and then will theſe ſtrait Lines be the Projections of the perpendicular Sections upon the Picture. And in order to find the Projections of the parallel Sections; from the Center C of the Picture, draw CE Fig. 91. perpendicular to AB, and equal to the Diſtance of the Eye; then from ab, cd, ef, and g, draw Lines to the Eye E, which cutting the Picture, will give 1 6 for the Projection of ab, 2 5 for that of cd, 3 4 for that of ef, and C the Center of the Picture for g the Center of the Dome; therefore, from the Line AB, transfer the ſeveral Diviſions A 1, 1 2, &c. unto the Line AB in the 90th Figure; and from the Point C, deſcribe the ſeveral concentric Circles through the Points 1, 2, 3; and ſo will the whole Picture be properly divided for the Work: For each Reticulation upon the

Picture, is the exact Projection of its correſponding and original Reticulation upon the Dome; and therefore, all that now remains, is, only to divide the Picture into an agreeable Number of Parts, and to conſider each Part as a parallel Picture, whoſe perpendicular Sides vaniſh into the Center of the Picture; and to be always careful to take the Center of the Model perpendicular to the ſuppoſed Place of the Eye; and the Diſtance to be work'd with muſt be the ſame as that between the Eye and the Plane AB, Fig. 91, as well for deſcribing the Model itſelf, as for the Reticulation.

We have hitherto conſidered the Eye as placed under the Center of the Dome, in which Caſe the Reticulation upon the parallel Picture is done with great Eaſe: But if it were placed obliquely, the Reticulation would become a little more troubleſome; in regard that in ſuch a Poſition of the Eye, the perpendicular Sections of the Dome would not form ſtrait Lines upon the parallel Plane, but Curves.

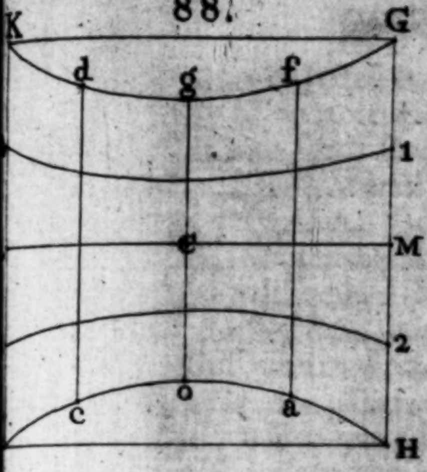
Fig. 92. Thus, let A g B, be a perpendicular Section of the Dome, and a b, c d, e f, its Sections with the horizontal Circles, as before; and let E be the Place of the Eye.

Then Lines drawn from E, to the Vertex g of the Dome, and to the Centers and either Extremity b, d, f, of the horizontal Diameters, will cut the Baſe of the Dome AB in correſponding Points; which being transferred by Perpendiculars to the Diameter AB of the parallel Plane, will give the apparent Vertex C, and the Centers and Radii of the Images of the horizontal Circles, on the parallel Plane; and theſe being drawn, and each divided into the ſame Number of equal Parts, as the Baſe of the Dome is ſuppoſed to be, Curve Lines drawn through the correſponding Diviſions of theſe Circles, will give the Projections of the ſeveral perpendicular Sections of the Dome, as in the Figure.

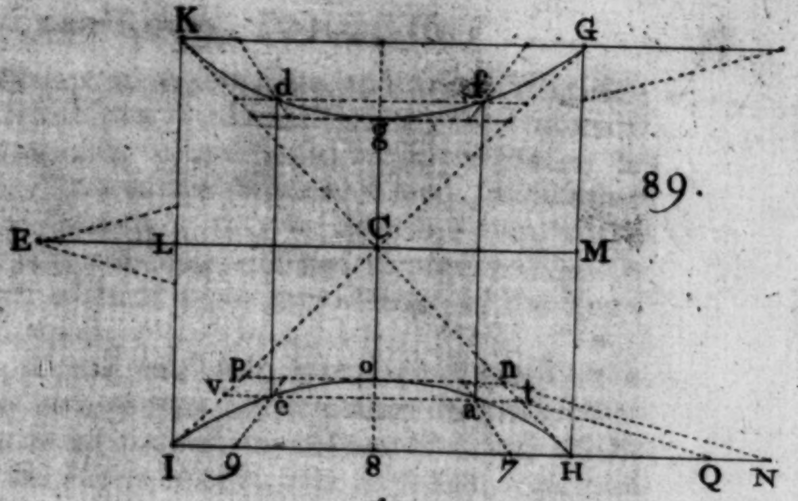
For as the horizontal Circles are all ſuppoſed parallel to the circular Plane ADBE, it is evident their Projections will ſtill remain Circles, and their Subdiviſions will be equal, like thoſe of their Originals.

And here all the perpendicular Sections of the Dome, form Curves upon the parallel Plane, except the Section A g B, which is projected into the ſtrait Line AB, the Eye being ſuppoſed to lye in the Plane of that Section. But in Painting on curvilinear Grounds, the moſt direct Situation of the Eye ought always to be choſen, that the Deſign, when painted, may appear the more agreeably; and indeed, in all ſuch Works, the Deſign ought, as much as poſſible,

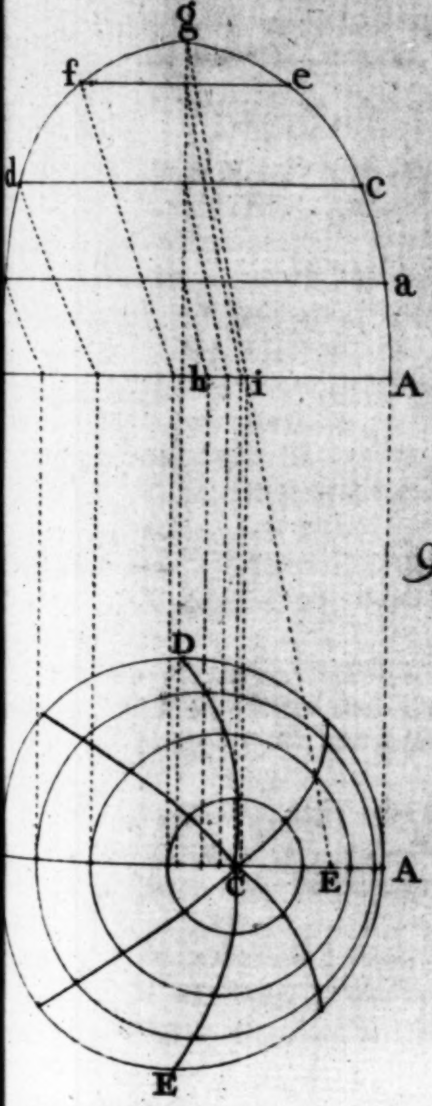
88.


K
G
d
g
f
1
C
M
2
c
o
a
H

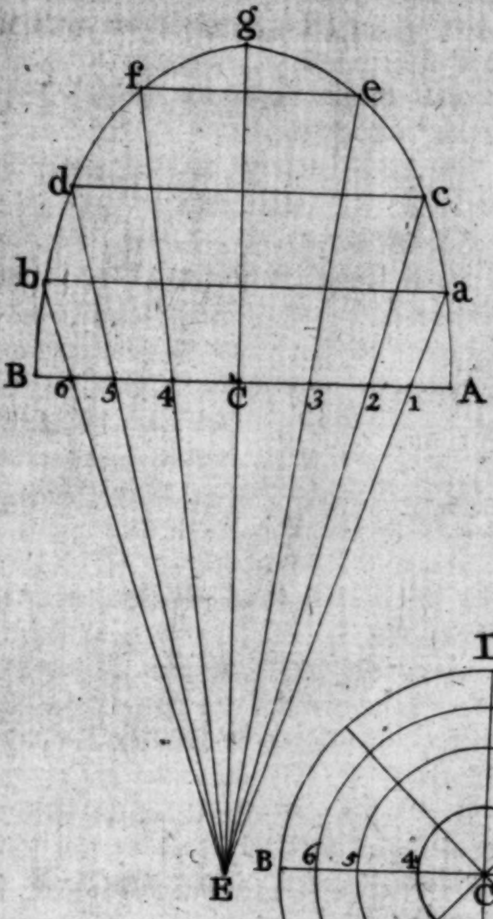
89.


K
G
d
f
g
E
L
C
M
p
o
n
v
c
a
t
I
9
8
7
H
Q
N

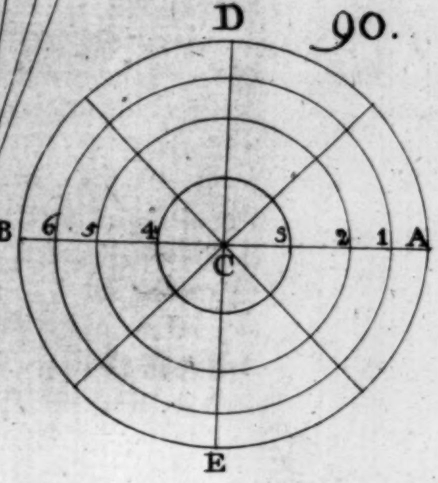
92.


g
f
e
d
c
a
h
i
A
D
C
E
A
E

91.


g
f
e
d
c
b
a
B
6
5
4
C
3
2
1
A
E

90.


D
B
6
5
4
3
2
1
A
C
E

BRITISH 1 JY64 MUSEUM

ſible, to be ſuited to the Shape of the Surfaces, and to conſiſt principally of ornamental Architecture fitted to it, (putting the Hiſtorical Part into ſmall Compartments, to be diſpoſed in proper Places) or elſe of ſome Aerial View, where the Sky and Clouds, with other Objects proper for that Situation, may be deſcribed; in which Caſe, the principal Objects not being confined to regular Figures, there will be leſs Danger of their appearing diſtorted by the Shape of the Surface painted upon.

But when a Cupola, Dome, or Vault, is to be deſcribed on a flat Ground, there may be a greater Liberty taken in placing the Eye; which may have either a direct or oblique Poſition, as the Artiſt judges beſt for the View he intends to repreſent, and will not be liable to thoſe Inconveniencies which attend Painting upon an uneven Ground.

CHAP.

CHAP. V.

The PERSPECTIVE *of* SHADOWS.

THE meaning of the Word Shadow is too obvious to need any Explanation, and therefore I ſhall not trouble the Reader about its Etymology, nor ſhall I conſider that infinite Variety of Shadows which may be projected by different Planes; but proceed to ſhew, that the Perſpective of Shadows upon the Picture, is to be determined after the ſame Manner as the Perſpective of Objects, being founded upon the ſame Principles, and deducible from the ſame Rules: It is therefore very ſurprizing, that almoſt every Author who has handled this Part of Perſpective, ſhould have committed ſuch egregious Miſtakes, in giving ſuch Rules as are falſe in Theory, and in Practice the moſt abſurd.

But to proceed. All Shadows are produced by the Interpoſition of ſome opake Objects, which ſtop the Progreſs of the Rays of Light in their direct Courſe from any luminous Body or Point. And ſince the Rays of Light do always proceed in ſtrait Lines, therefore, when they paſs over the Extremities of an Object, they leave a Space unilluminated, which Space is called, *the Projection of the Shadow of that Object:* And 'tis the Buſineſs of this Part of Perſpective, to determine the Appearance of that Projection upon the Picture. In order to do which, we muſt firſt conſider whether the Light be ſuppoſed to come from the Sun, a Candle, or any other luminous Point: If from the Sun, then, from its immenſe Diſtance with reſpect to us, the Rays may be conſidered as parallel; but if from a Candle, as flowing from a Point in a diverging Manner.

And in regard to the Theory of the Perſpective of Shadows; there needs but little more to be ſaid than what has been already advanced upon the Perſpective of Objects: For ſince every Ray of Light is to be conſidered as a ſtrait Line, that Line may be conceived to lie in ſome Plane; and therefore, if the Repreſentation of that Plane can be eaſily found upon the Picture, the Repreſenſentation of a Line which is in that Plane, may be eaſily found alſo.

And here let us obſerve, that the Planes in which I ſhall ſuppoſe the Rays of Light to be, will always be conſider'd as perpendicular to the Horizon, as that will be fitter for our Purpoſe, and render the Thing more intelligible.

If the Rays of Light come from the Sun in Planes parallel to the Picture, they then can have no vaniſhing Point; in this Caſe, therefore, the Shadows will be parallel in the Picture: But if they come in Planes not parallel to the Picture, then becauſe a Line drawn from the Eye parallel to thoſe Rays will cut the Picture in ſome one Point, therefore they will have a vaniſhing Point upon the Picture, which will be the common vaniſhing Point for all the Rays in that Direction, whether they be all in one Plane or in any Number of Planes, provided thoſe Planes are parallel to one another.

SECT. I.

Of SHADOWS *projected by the* SUN.

LET HP repreſent a Plane parallel to the Horizon, or, if you pleaſe, the Ground Plane, and let ABCD repreſent a Plane of parallel Rays, as EL, Dd, *&c.* each Ray making an Angle, RLA, with the Ground Plane. Fig. 93.

Now, in order to find the Perſpective of any Shadow upon the Picture, two Things are neceſſary to be given;* *viz.* the Inclinanation, or Angle, which any Syſtem of Rays makes with the Ground Plane, and the Situation of the Plane (in reſpect to the Picture) in which thoſe Rays are ſuppoſed to be. As to the Angle of Inclination, that may be given by a ſingle Ray only; for ſince the Rays RL, Dd, *&c.* are all ſuppoſed parallel amongſt themſelves, therefore the Angle RLA, which any ſingle Ray RL makes with the Plane HP, is common to all the reſt: And as to the Situation of the Plane of Rays, that is to be choſen at the Diſcretion of the Artiſt, ſo as to be moſt productive of Effect as to his main Deſign.

LEMMA I.

If the Rays of Light come from behind the Picture towards the Spectator's Eye, then the vaniſhing Point of thoſe Rays will be above the horizontal Line.

Let PQ be the Ground Plane, GO the Picture, E the Eye, EC the Diſtance of the Picture, C the Center of the Picture, HC the Fig. 95.

---

* What is here ſaid to be given, is excluſive of the Diſtance of the Eye, the Center of the Picture, *&c.* which, it is preſumed, will be taken for granted, without mentioning them.

horizontal Line, ABOD a Plane of parallel Rays interſecting the Picture at right Angles in the Line BO; and let RL be a Ray of Light, and RLA the Angle of Inclination which the Rays make with the Ground Plane.

Through the Eye E, draw EF parallel to any of the Rays, as RL, cutting the Picture in F; then is F the vaniſhing Point of all the Rays of Light; for EF being paralled to one Ray is parallel to all the reſt.---Now, ſince the Plane of Rays ABCD is perpendicular to the Picture, and paſſes through C the Center of the Picture, therefore the Plane BFEH, which paſſes through the Eye, will be perpendicular to the Picture, and will paſs through its Center alſo; and therefore BO, the common Section of theſe two Planes, will be the indefinite Repreſentation of the Plane ABCD; and conſequently, F, where EF cuts the Picture, will be the vaniſhing Point of the Rays RL, *&c.*

COROL. 1.

Since the Plane of Rays paſſes through the Center of the Picture, the vaniſhing Point of the Rays will be in a Line drawn from the Center of the Picture perpendicular to the horizontal Line.

COROL. 2.

From hence alſo, we may perceive, that C may repreſent the Seat of the luminous Point; for the Seat of the real Luminary is ſuppoſed to be in a Plane parallel to the Plane of the Horizon; and therefore, if we conſider A, the Seat of R, as at an immenſe Diſtance, and ſuppoſe R a real luminous Point, then will C be the Repreſentation of the Seat R; that is, the Seat of a luminous Point upon the Picture, which is ſuppoſed to be at an immenſe Diſtance from it: Or, in other Words, ſince C is the vaniſhing Point of LA infinitely extended, therefore, it is alſo the vaniſhing Point of any Point in that Line at an immenſe Diſtance.

COROL. 3.

And here likewiſe we may obſerve, that in order to find the vaniſhing Point of a Ray of Light, or of any Number of parallel Rays, we need only have the Angle of Inclination given; then by ſetting off the Diſtance of the Picture upon the horizontal Line, and making an Angle at that Point of Diſtance with the horizontal Line, equal to the given Angle of Inclination, we may determine the vaniſhing Point of thoſe Rays; as is ſhewn in the 98th Figure, which will be more fully explained hereafter.

LEMMA 2.

In the laſt Figure we conſider'd the Rays as coming in a Plane perpendicular to the Picture; we will now ſuppoſe them to come in a Plane oblique with the Picture.

Let ABOD be a Plane of Rays which cuts the Picture obliquely in the Line OB, every thing elſe remaining as in the former Figure. Fig. 96.

Through the Eye E draw the Plane HLLE, cutting the Picture in LL; then continue LL upwards beyond F, at pleaſure, and from E draw EF parallel to the Ray of Light RL; then is F the vaniſhing Point of that Ray, &c.

COROL. 1.

From hence we may obſerve, that when the Light comes from behind the Picture towards the Spectator's Eye, the Seat of the Rays will always be upon the horizontal Line, and in that Point which is the vaniſhing Point of the Plane in which the Rays are ſuppoſed to come: Thus, L is the vaniſhing Point of the Plane ABOD, and it is alſo the Seat of the Rays of Light. Fig. 96.

COROL. 2.

And from hence alſo it follows, that when the Light comes from behind the Picture, the Shadows of Objects will be thrown towards the Bottom of the Picture.

LEMMA 3.

When the Rays come from behind the Spectator's Eye towards the Picture, (that is, when the Spectator is between the real Luminary and the Picture) then the vaniſhing Point of thoſe Rays will be below the horizontal Line.

Let FHIL be the Picture, E the Eye, C the Center of the Picture, and CE its Diſtance; and let ABOD be a Plane of parallel Rays whoſe Seat upon the Ground Plane is in the right Line LH continued: Or in other Words, ſuppoſe the Plane of Rays was continued towards the Picture in the Line BL, it would paſs thro' the Eye E, and would cut the Picture in the Line LI. Fig. 97.

Through the Eye E, and its Seat H, draw EC, HL, parallel to AB or CD; and from L, where HL cuts the Section GL, draw LC parallel to AD; then is EHLC a perpendicular Plane which paſſes through the Eye parallel to the Plane of Rays ABOD, cutting the Picture in LC; therefore LC is the indefinite Repreſentation of the Plane ABOD, and LC continued will be the vaniſhing Line of all the Rays which can come in that Plane; and if EF be drawn parallel to RL, then is F the vaniſhing Point of that Ray, and C its Seat upon the horizontal Line HL.

For ſuppoſe the Plane ABOD to be tranſpoſed into the Line XZ, and it will be like the Plane ABOD in the 95th Figure, with this Difference only, that the Rays coming in a contrary Direction, will have their vaniſhing Point upon the Picture below the horizontal Line.

COROLLARY.

When the Light comes from behind the Spectator's Eye towards the Picture, the Shadows of Objects upon the Picture will be thrown towards the horizontal Line; and ſince the Light is generally ſuppoſed to come upon the Front of the Picture, and not from behind it, therefore theſe Kind of Shadows are moſt generally uſed.

I ſhould have been more particular in the Explanation of this Figure, if there appeared the leaſt Difficulty to me in underſtanding it: Indeed, as the Eye is ſuppoſed to be between the Picture and the original Object, it may ſeem to contradict our general Definition of Perſpective, in which we have always conſider'd the Picture as placed between the Eye and the original Object; and therefore this Lemma may appear not to be ſo aptly drawn from the preceding Theorems* as it really ought to be: Yet, ſince the Method for determining a vaniſhing Line, or Point, is the ſame in either Caſe, *viz.* by imagining a Plane to paſs through the Eye, parallel to the original Plane, 'till it cuts the Picture, *&c.* I have, therefore, only explained that ſingle Article, and endeavoured to make myſelf underſtood in the moſt familiar Manner; not ſo much regarding a ſtrict mathematical Demonſtration, nor yet that Order or Method which would be neceſſary were this Treatiſe purely Mathematical.

LEMMA 4.

When the Rays of Light come in Planes parallel to the Picture, they can have no vaniſhing Point; becauſe a Plane which paſſes through the Eye parallel to thoſe Planes, and which in other Caſes would cut the Picture, and thereby produce a vaniſhing Line, in this Caſe can never cut the Picture, and therefore cannot produce any vaniſhing Line: From whence it follows, that when the Rays come in this Direction, the Appearance of their Shadows upon the Picture will be parallel, for the very ſame Reaſon that the Repreſentation of any original Plane which is parallel to the Picture, is exactly like its Original.

---

* Chap 3. Sect. 2. of this Book.

We will now give ſome general Rules for applying to Practice what has been ſaid upon this Head. In order to do which, let AB repreſent a Picture laid flat, as in the preceding Examples; Fig. 98. and let HL be the horizontal Line, C the Center of the Picture, and CE its Diſtance.

METHOD 1.

To find the vaniſhing Point of a Ray of Light, when it is ſuppoſed to come from behind the Picture towards the Spectator's Eye, in a Plane like ABCD, Fig. 95, which cuts the Picture in its Center;

Any where apart, draw NP parallel to the horizontal Line HL, Fig. 98. and draw NO for the Ray of Light; then is ONP the Angle of Inclination.—Through C the Center of the Picture, draw EK perpendicular to HL, and continue it at pleaſure; then make CH equal to the Diſtance EC, and from H draw HD parallel to the Ray NO, cutting CE in D; and then is D the vaniſhing Point of the Rays of Light. For ſince EK is the vaniſhing Line of the Plane of Rays, C the Center of that vaniſhing Line, and CH equal to its Diſtance, therefore, H may be conſidered as the Eye; and conſequently, ſince HD is drawn from that Point parallel to the original Line NO, the Point D, where it cuts the vaniſhing Line ED, is the vaniſhing Point of that original Line.

METHOD 2.

When the Rays come from before the Picture, as in Fig. 97;

Every Thing remaining as before;--Let TW be a Ray of Light, Fig. 98. and VTW its Angle of Inclination.---From H draw HK, parallel to the Ray TW, cutting the vaniſhing Line EK in K; then is K the vaniſhing Point required.

METHOD 3.

When a Ray of Light comes from behind the Picture in a Plane oblique with the Picture, as in Fig. 96;

Let IG be the vaniſhing Line of a Plane of Rays, RS a Ray Fig. 98. of Light, and RSQ its Angle of Inclination.---Continue the horizontal Line beyond L at pleaſure, and from F, the Center of the vaniſhing Line, draw FE; then is FE the Diſtance of that vaniſhing Line; therefore by making FL equal to the Diſtance FE, and by drawing LI parallel to the Ray RS, we ſhall have I for the vaniſhing Point of that Ray.

METHOD 4.

When a Ray comes from behind the Spectator's Eye towards the Picture, in a Plane oblique with the Picture;

Fig. 98. Let IG be the vaniſhing Line of that Plane, ZY a Ray of Light, and XYZ its Angle of Inclination.---From L, the tranſpoſed Place of the Eye, draw LG parallel to the Ray ZY, which will give G for its vaniſhing Point.

COROLLARY.

From hence let us remember, that the Center C, or F, of a vaniſhing Line EK, IG, will be the vaniſhing Point of the Shadow upon the Ground; becauſe the Seat of the Ray upon the Picture, will always be the vaniſhing Point of the Shadow of any perpendicular Object; for it muſt be in the horizontal Line, and alſo in the vaniſhing Line, of the Plane of Rays; ſuch are the Points C and F; and therefore, henceforward I ſhall conſider ſuch Points as the vaniſhing Points of the Shadow, and call them by that Name.

To find the Shadow of an Object which is ſuppoſed to ſtand perpendicular to the Ground, when the Rays come in Planes parallel to the Picture;

Fig. 99. Let FG be the Picture, AB the Repreſentation of a perpendicular Object whoſe Shadow is ſought; and let HL be a Ray of Light, whoſe Inclination with the Ground is equal to the Angle HLC.---Through B, the Seat of the Object, draw E a at pleaſure, but parallel to the horizontal Line; and through A draw R a parallel to the Ray HL, cutting E a in a; then is B a the Shadow of BA.

Fig. 100. Again, Let a b c d be a perpendicular Plane, whoſe vaniſhing Point is C the Center of the Picture, and let HL be a Ray of Light.----Through the Seats a, b, of the Perpendiculars a d, b c, draw a f, b e, parallel to the horizontal Line, and through d, and c, draw L f, R e, parallel to the Ray HL, cutting a f, b e in f and e; finally, from f and e, draw f e, then is a b e f the Shadow of

the Plane a b c d, and f e continued will vaniſh into C, the vaniſhing Point of a b, and c d.

Now, when the Shadow of any perpendicular Object is produced by Rays which are ſuppoſed to come in Planes parallel to the Picture, that Shadow may be found by Calculation: Thus, when the Angle of Inclination is 45 Degrees, then the Shadow will be equal to the Height of the Object, as in the two laſt Figures; therefore, by putting Unity for the Height of the Object, we may have the following Proportions, *viz.*

Angle of Inclination.			*Length of the Shadow.*
Deg.	Min.		
90	00		No Shadow.
78	45		1-5th Part of the Object.
67	30		2-5ths ditto.
56	15		7-10ths ditto.
45	00	is	The Height of ditto.
33	45		1 2 once the Length of ditto and Half.
22	30		2 4-9ths, twice the Len. of ditto and 4-9ths.
11	15		5 Times the Length of ditto.
00	00		Infinite.

From hence, then, we ſee the Reaſon why the Shadows produced by the Sun are very long in a Morning and Evening, and why they grow ſhorter and ſhorter the nearer the Sun approaches to the Meridian.

The foregoing Rules applied to Practice.

To find the Shadow of an Object, when the Light comes from behind the Spectator towards the Picture.

Fig. 101. Let AB be the Picture, C its Center, CE its Diſtance, IK a Ray of Light, L the vaniſhing Point of the Shadow, D the vaniſhing Point of the Rays of Light, and a b c d, a perpendicular Plane whoſe Shadow is ſought.

From a and b, the Seats of the Perpendiculars a d, b c, draw Lines to L, the vaniſhing Point of the Shadow; and from d and c, the Extremities of a d, b c, draw Lines to D, the vaniſhing Point of the Rays; then from where they cut a L and b L, draw e f, and then is a b f e the Shadow of a b c d; which if continued will vaniſh into C, the vaniſhing Point of a b, c d.

To find the Shadow of an Object when the Light comes from behind the Picture.

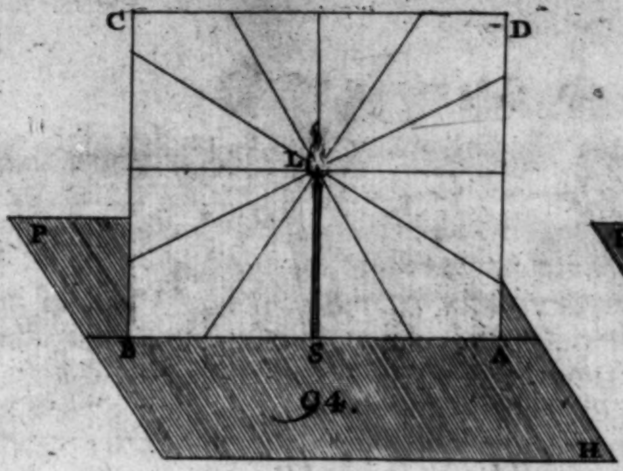
Fig. 102. In this Figure, H is given for the vaniſhing Point of the Shadow, KI for a Ray of Light, and KIL for its Inclination.—Draw FD parallel to IK, which will give D for the vaniſhing Point of the Rays of Light; then from the Point H of the Shadow, draw Lines through all the viſible Corners, a, e, f, of the Object, and continue them at pleaſure; then from D, the vaniſhing Point of the Rays of Light, draw Lines through the upper Corners b, c, d; which will give the Points g, h, i, from whence the Shadow a g h i f, may be compleated.

In the two laſt Figures, I have drawn out every Line and Point which is neceſſary in the Work, and have alſo added the Angles IGK, IKL, for the Inclinations of the Rays, to make the Thing more intelligible.

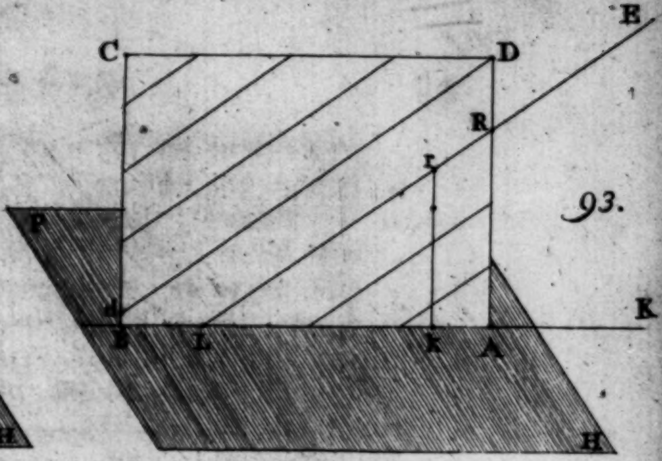
Here let us obſerve, that the Shadow of every perpendicular Line, will vaniſh into the vaniſhing Point of the Shadow; and the Shadow of every oblique Line, will vaniſh into the vaniſhing Point of that Line: Thus a g is the Shadow of the Perpendicular a b, and h i of the oblique Line c d, as was obſerved before, in Corollary Page 89.

I have hitherto conſidered Shadows as projected upon the Ground, and the Objects which project them as perpendicular to it; but by the ſame Rules any other Shadows are to be determined, whether the Planes upon which they are caſt are perpendicular, parallel, or oblique, or however the Objects which project them are ſituated: And therefore, thus much might have ſufficed to explain the Theory and Practice of Shadows, ſo far as is neceſſary in a Picture; but that this Part of Perſpective may be made as familiar as poſſible, I have added ſeveral uſeful Examples in the Practical Treatiſe, Book the Second.

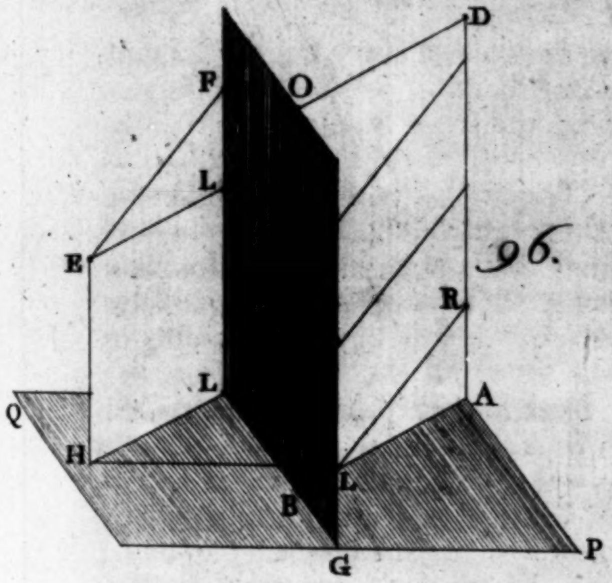
XVIII.



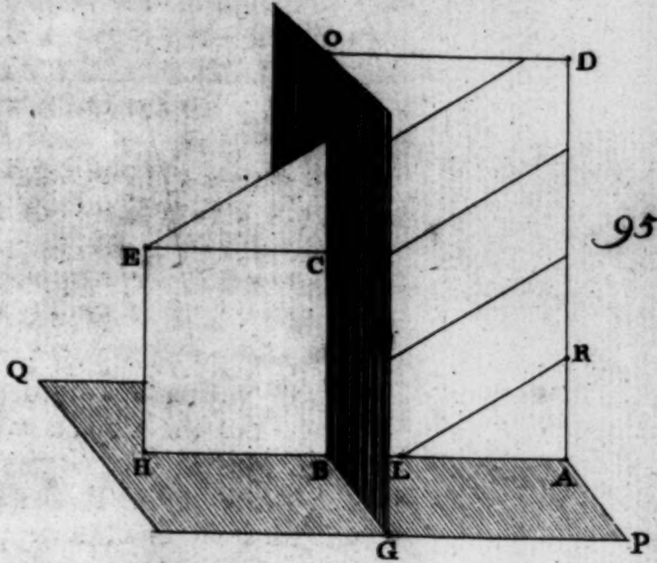
94.



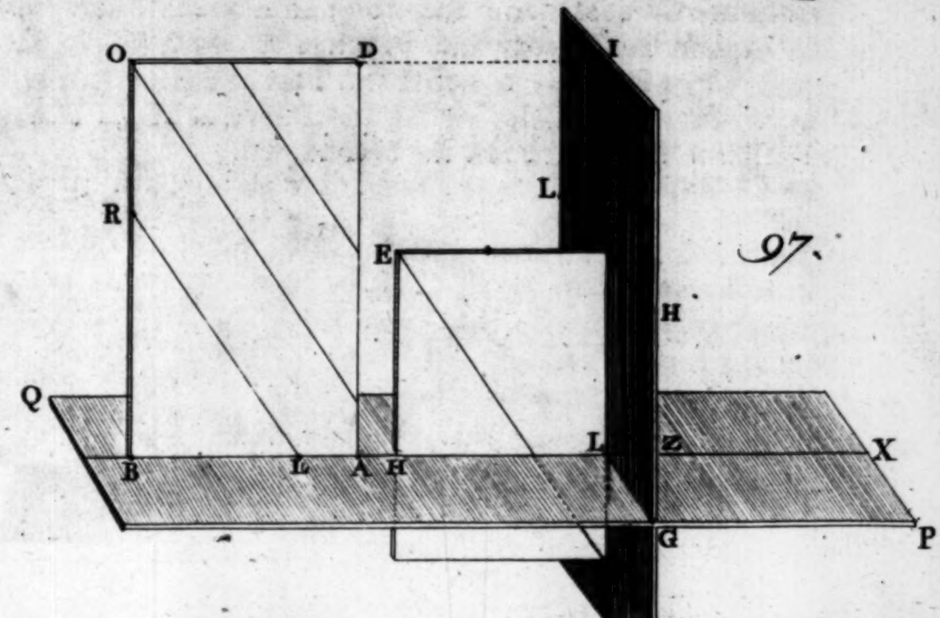
93.



96.

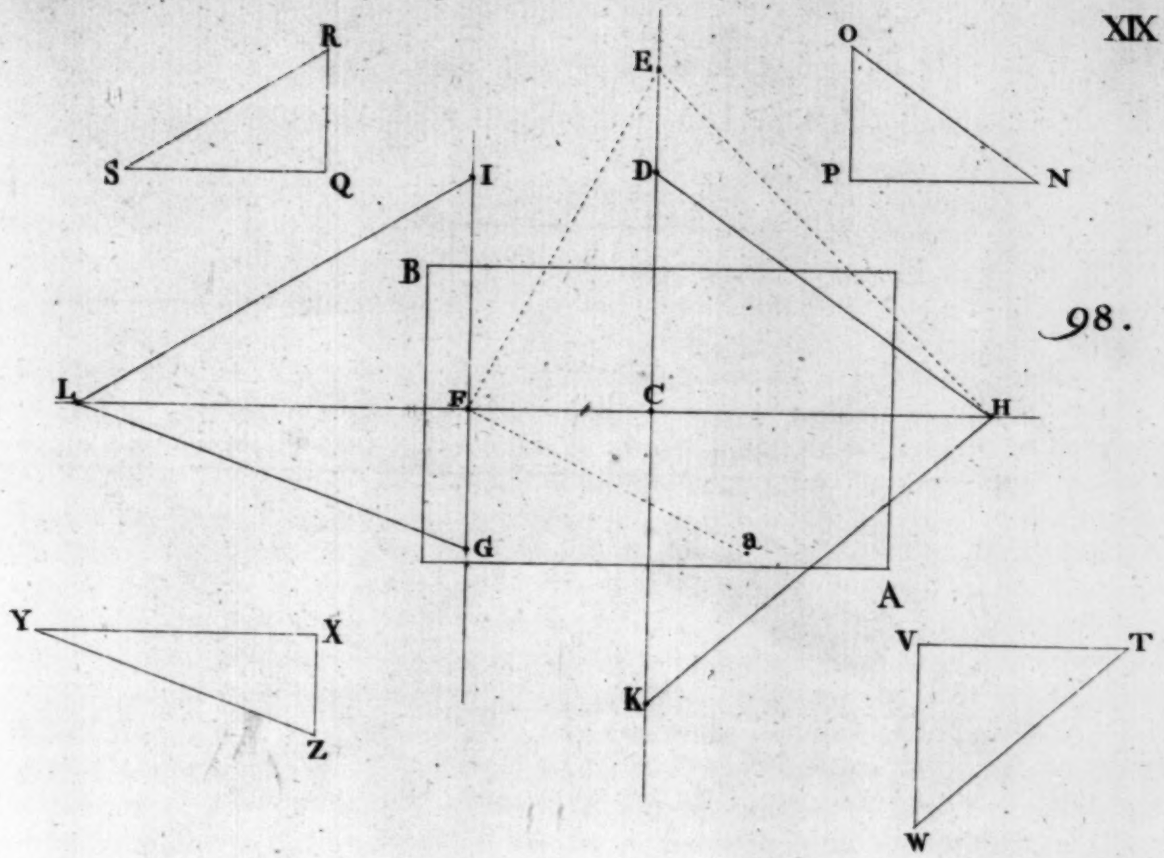


95.



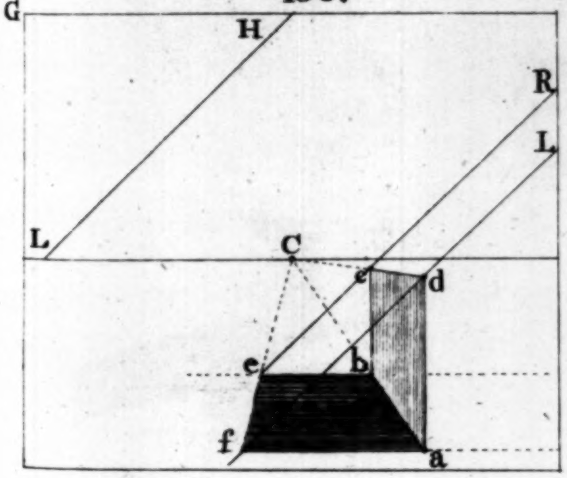
97.

BRITISH 1 JY64 MUSEUM

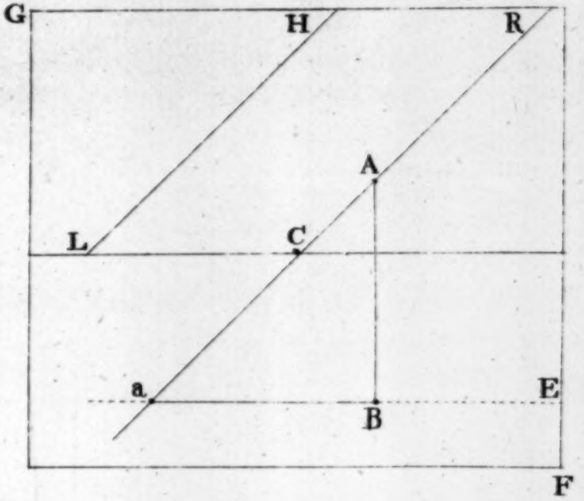


98.

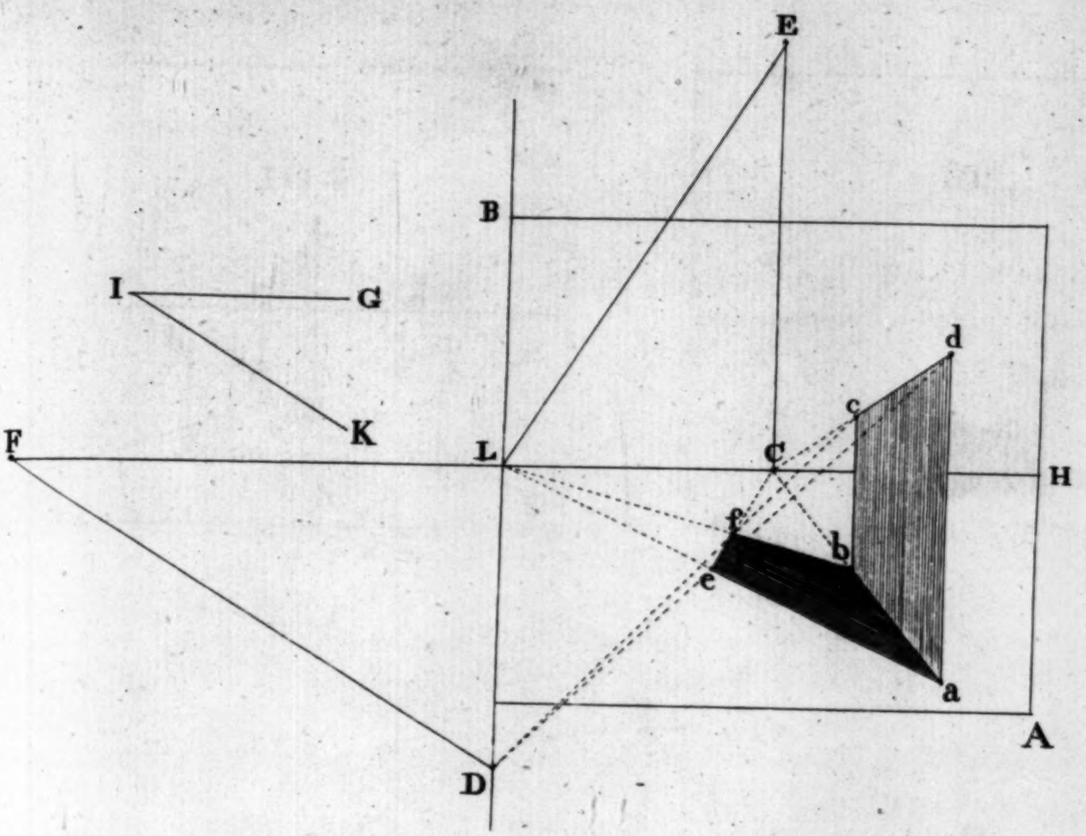
100.



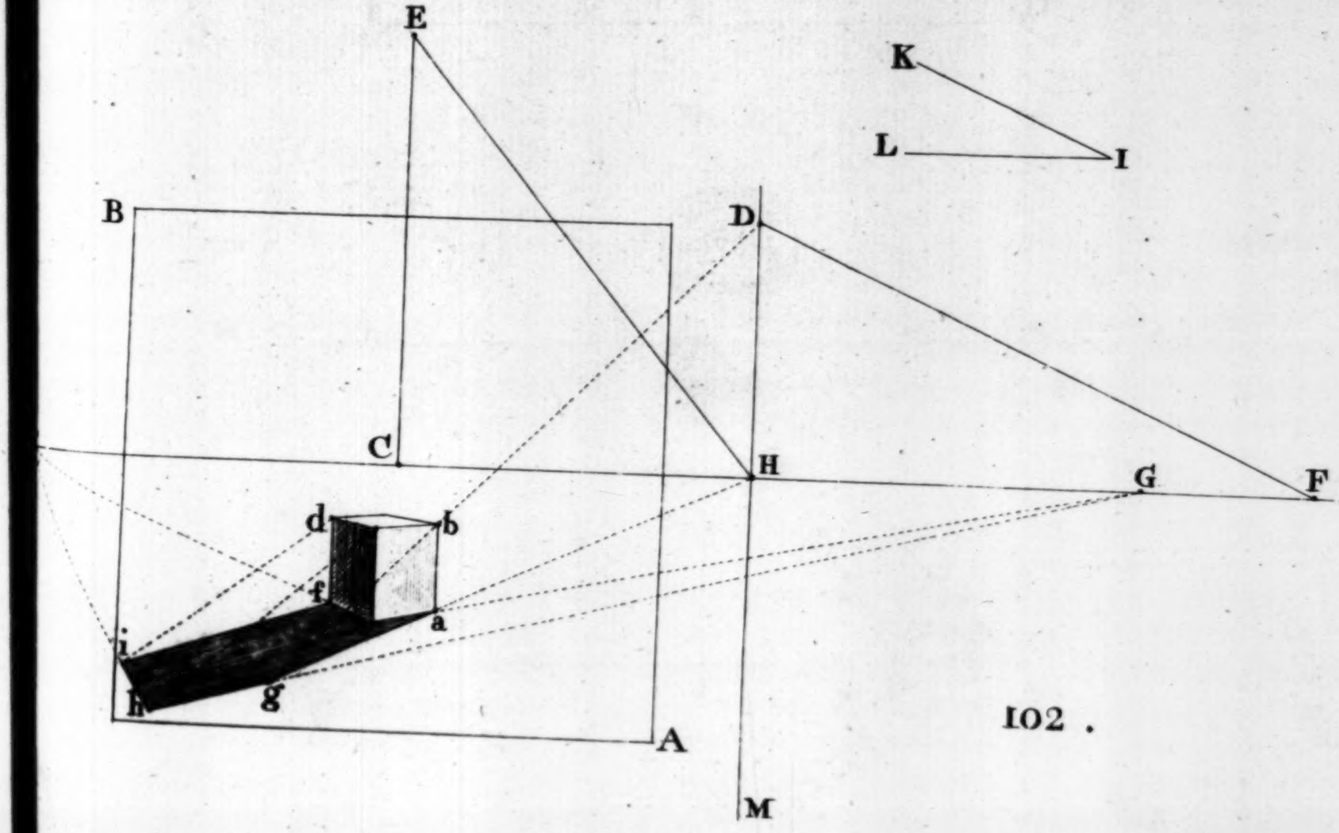
99.



BRITISH 1 JY64 MUSEUM



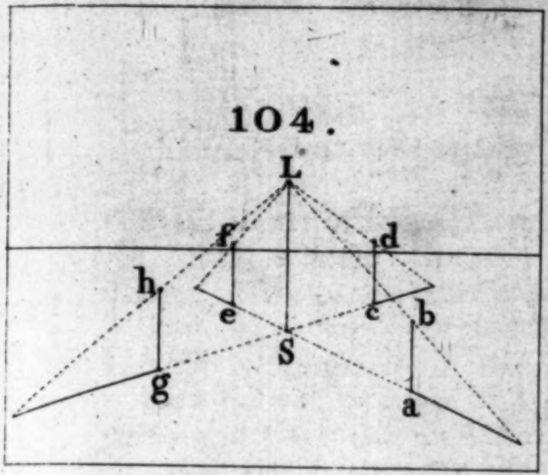
101.



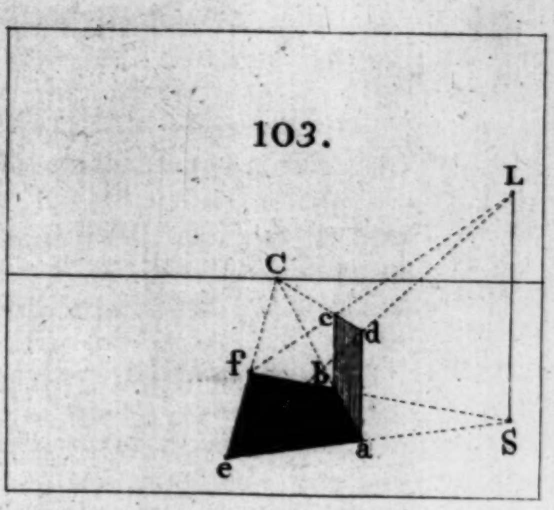
102.

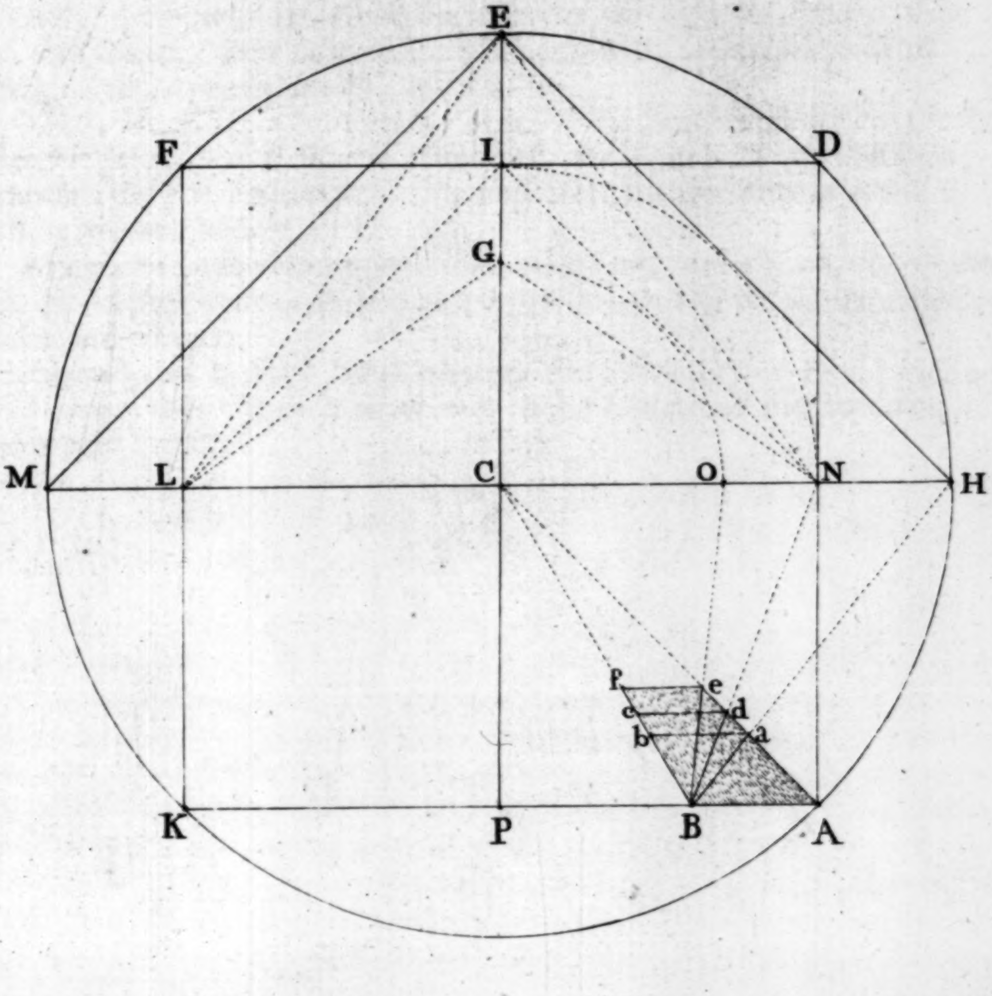
BRITISH
1 JY64
MUSEUM

104.



103.





105.

BRITISH
1 JY64
MUSEUM

SECT. II.

Of SHADOWS *projected by the* CANDLE, LAMP, *&c.*

THE Rays of Light from a Candle may be conceived to flow from a ſingle Point, like the ſeveral Radii of a Circle from its Center. The 94th Figure repreſents a Plane of theſe Rays, which is ſuppoſed to ſtand perpendicular to the Ground Plane HP; where L is the luminous Point, and S its Seat upon the Ground.

Now ſince theſe kinds of Light are but ſeldom choſen for a Picture; and ſince the Method for determining Shadows projected in this manner, is extremely eaſy; there needs but very little to be ſaid upon it: I ſhall therefore put an End to this Chapter with the utmoſt Brevity.

The firſt Thing neceſſary in order to determine the Shadow by a Candle, is, to give a luminous Point, and its Seat in the Picture; then by drawing Lines from thoſe Points through the Extremities of any Object, their mutual Interſections with each other will determine the Appearance of that Shadow.

Thus, let L be a luminous Point, S its Seat, and abcd the Representation of a ſquare Plane: From S and L draw Lines through the Extremities a, b, c, d, and their Interſections at e and f will give the Shadow aefb. Fig. 103.

Again, let L be a luminous Point, S its Seat, and ab, cd, ef, gh, be the Repreſentation of ſeveral perpendicular Objects whoſe Shadows are ſought: Fig. 104.

From S and L draw Lines through the Extremity of each Line, and where they cut each other will be the Length of the Shadows, as in the Figure.

CHAP. VI.

Of the Diſtance and Height of the Eye, of the Size of the Picture, and of the true Point of Sight, &c. with ſome Conſiderations upon the Appearance of circular Objects upon the Picture.

I. *Of the* DISTANCE *of the* EYE.

THE chooſing a proper Diſtance for the Eye is ſo eſſential in all Perſpective Repreſentations, that without a nice Obſervance thereof every Object will appear unnatural and prepoſterous, be the Rules by which it was drawn ever ſo true in Theory, or ſo exactly obſerved in Practice. And the Reaſon of this will appear extremely obvious, if we conſider that there is a certain Diſtance at which the Eye can ſee an Object with more Diſtinctneſs than in any other Point of View. Now, That Diſtance may be called the *true Point of Sight* in reſpect to That Object; and what is ſaid of one Object will hold equally true of any Number of Objects: And therefore, as it is the Buſineſs of Perſpective to draw the Repreſentations of Objects as they appear to the Eye, under the moſt agreeable Shape, it follows, that the Diſtance to be work'd with upon the Picture, ſhould be choſen in ſuch a Manner that each Repreſentation ſhall make the ſame agreeable Figure to the Eye, as the Originals themſelves would do were they ſeen under the ſame Angle.

Fig. 105. To explain the Senſe of this more fully, let ADFK be a Picture, C its Center, NL the horizontal Line, AB one Side of a geometrical Square parallel to the Picture; and let it be required to find the Repreſentation of that Square as ſeen at the ſeveral Diſtances CG, CI, CE.

From A and B draw Lines to C, the vaniſhing Point of the oblique Sides; and from C, ſet off the ſeveral Diſtances of the Eye upon the horizontal Line in the Points O, N, H; then from theſe Points draw Lines to B, cutting AC in the Points a, d, e; and from a, d, e, draw Lines parallel to AB: Then ſhall we have the Repreſentation ABab as ſeen at the Diſtance CE, the Repreſentation ABcd as ſeen at the Diſtance CI, and the Repreſentation ABfe as ſeen at the Diſtance CG.

Now, by inſpecting the Figure, we ſhall find that the apparent Depth Ae, of the Repreſentation ABfe, which ought to be foreſhorten'd, is longer than the parallel Side AB, ſo that the Figure which ſhould repreſent a Square, is a Parallelogram; and therefore this Repreſentation will not appear to be true: And if the Diſtance be at I, then the Depth will be longer than it ought, becauſe the Figure ABcd will ſtill look like a Parallelogram: But if the Diſtance be taken at E, then the Repreſentation will appear of a more proper Depth; and therefore the Diſtance CE is properer for a Picture of this Dimenſion. And if Lines are drawn from the ſeveral Points of View G, I, E, to the Extremities N and L of the Picture, then theſe Lines will ſhew the Angles under which the Picture is ſeen at thoſe Diſtances; *viz.* that at G will be an obtuſe one, that at I a right one, and that at E an acute one: And therefore from hence we may conclude, that the Angle under which any Picture is to be ſeen, ought never to be ſo great as a right one; and, by making an Experiment, we ſhall find, that if it is much leſs than an Angle of 50 Degrees, the apparent Depths of ſquare Objects will be too much foreſhorten'd, by which Means thoſe Objects which ſhould repreſent ſquare Bodies, will appear like ſo many Parallelograms: However, for Pictures with curvilinear Objects, the Diſtance ſhould be taken as great as poſſible; which is left to the Diſcretion of the Artiſt.

There are ſeveral other Reaſons to be given for chooſing a proper Diſtance for the Eye; but as one Example is ſufficient to ſhew the Abſurdity and Inconveniency of diſregarding, or not knowing, this eſſential Part of Perſpective, it becomes needleſs to produce any others.

2. *Of the* HEIGHT *of the* EYE.

'TIS the Height of the Eye that determines the Height of the horizontal Line from the Bottom of the Picture, and therefore, it is that which gives the whole Space for the Repreſentation of the Ground. And in taking the Height of the Eye, we muſt be careful not to let it be ſo great as the Diſtance of the Eye, ſince the ſame bad Conſequences will follow from thence as in chooſing an improper Diſtance. For let PP be a perpendicular Section of the Picture, AP an original Line perpendicular to it, and HE the Height of the Eye.---Draw AE, and then will Pc be the Repreſentation of PA: But if the Eye be placed at I, ſo as to be equal to its Diſtance IP, then will the Repreſentation PC be too long in the Fig. 106.

the Picture; and the nearer the Eye is brought to P, (ſuppoſe at Q) that is, the more the Height QR exceeds the Diſtance QP, the more prepoſterous will the Repreſentation Pa appear. Indeed, if any original Object, as AB, be parallel to the Picture, the Height of the Fig. 107. Eye will have no Effect upon this kind of Repreſentations, provided the Eye moves in the ſame perpendicular HI; for the Repreſentation ab, is equal to the Repreſentation CP.

3. *The Conſequences of viewing Pictures from any other than the true Point of Sight.*

FROM what has been ſaid upon the Diſtance and Height of the Eye, it muſt be manifeſt, that no Perſpective Repreſentations will appear ſo natural as when viewed from the true Point of Sight; becauſe, at that Point, all the Rays which are ſuppoſed to come from the original Objects, and produce their ſeveral Projections upon the Picture, will concur at the Eye in their proper Point, and thereby exhibit a Picture upon the Retina exactly ſimilar to that of their Originals.

But again, If the Eye is not placed in the true Point of Sight, the Projection of all Objects which are not parallel to the Picture, will not ſeem to tend to their proper vaniſhing Points; and for that Reaſon ſuch Repreſentations will ſeem to ſtart out of their proper Places, will loſe their juſt Proportions, and conſequently, will convey a jumble of confuſed Appearances to the Eye: And to this we may add alſo, the ſhocking Effect it will have upon the horizontal Line in particular, which is always governed by the Place of the Eye.

What has been ſaid upon this Head, relates principally to Pictures painted upon uneven Grounds, ſuch as Domes, vaulted Roofs, irregular Walls, *&c.* where the leaſt Variation from the true Point of Sight, will be productive of the above, and other bad Conſequences: For as to flat Pictures, the Fancy will be ready to give ſome Aſſiſtance towards correcting what is not ſtrictly right in them, and therefore, a little Variation of the Eye from the true Point of Sight, is allowable in ſuch Caſes; for no great Inconveniency will appear, ſo long as the Eye keeps upon a Level with the horizontal Line.

4. *Of the* SIZE *of the* PICTURE.

THE Size of the Picture is to be governed by the Diſtance and Fig. 105. Height of the Eye.---Thus, let CE be the Diſtance of the Eye, and CP its Height.

With the Diſtance CE deſcribe the Circle FKAD, and make CI equal to CP; through P and I draw AK, DF, parallel to the horizontal Line, cutting the Circle in A, K, D, F; from which Points draw the Lines AD, FK: Then ſhall we have a Square, which will give the utmoſt Size a Picture ſhould be of if ſeen from no greater Diſtance than CE. But if the Height of the Eye be leſs than CP, then the Picture will be a Parallelogram, which is the moſt general Shape given to Pictures.—This Method of limiting the Size of the Picture to the Diſtance and Height of the Eye, will be of great Uſe in ſeveral Operations.

5. *Some Conſiderations upon the Appearance of round Objects upon the Picture.*

FROM what has been ſaid upon the Diſtance of the Eye, *&c.* it may ſeem very improbable that any perſpective Repreſentation ſhould have a diſagreeable Effect, if the Rules we have laid down be nicely obſerved: Yet there are ſome Caſes, perhaps, in which the Artiſt will think it better to be guided by his own Judgment, than to follow the ſtrict Rules of Perſpective. This ſeems to have been the Opinion of Monſieur *Freſnoy*; for in his excellent Poem upon Painting, tranſlated by Mr. *Dryden*, he ſays, "Though "Perſpective cannot be called a perfect Rule for deſigning, yet it "is a great Succour to Art, and facilitates the Diſpatch of the "Work; tho', frequently falling into Error, it makes us behold "Things under a falſe Aſpect; for Bodies are not always repre"ſented according to the Geometrical Plane, but ſuch as they ap"pear to the Sight." But as there are different Opinions upon this Subject, I ſhall beg Leave to offer my Thoughts upon it.

Suppoſe it was required to draw the Repreſentation of a Range of Columns parallel to the Picture; if they are drawn according to the ſtrict Rules of Perſpective, then that Column which is in the Center of the Picture will be the leaſt, and conſequently, thoſe on each Side of it will be larger and larger continually, the farther they are removed from the Center of the Picture. But to explain this more fully: Let KLMN be a Plane which paſſes through the Eye parallel to the Ground; then will PP be the horizontal Line, and C the Center of the Picture: And let AB, CD, EF, be three Columns cut by this Plane; then let Lines be drawn from the Extremity of each Circle to the Eye; and the Sections a b, c d, e f, with the Fig. 108.

the Picture, are the Projections of thoſe Circles upon the Picture; and by meaſuring the ſeveral Repreſentations we ſhall find, that c d, and e f, are much longer than a b: From whence we may conceive, that the farther any Column is removed from the Center of the Picture, the longer will be its Repreſentation; and we may moreover conceive, that this Increaſe of the apparent Magnitude of the Columns, is owing to the Obliquity of the Lines g h, i k, with the Picture, which Lines meaſure their apparent Widths. Now the Queſtion is, whether Columns ſituated in this manner are to be thus repreſented upon the Picture, or not?

The Definition I have given of the Word Perſpective, is this, *viz.* To draw the Repreſentations of Objects as they appear to the Eye, *&c.* and have avoided the more general Definition, *viz.* of drawing the Repreſentation of Objects by the Rules of Geometry, *&c.* as it appeared to be more ſignificant of what I intended to expreſs by the Term Perſpective. For ſince the Fallacies of Viſion are ſo many and great*, and ſince we form our common Judgment and Eſtimation of the Appearance of Objects from Cuſtom and Experience †, and not from mathematical Reaſoning; therefore it ſeems

reaſon-

---

* The ingenious Dr. *Smith*, in his Treatiſe upon Opticks, has given us ſeveral Inſtances of the Fallacies in Viſion, amongſt which, he ſays, “ We are frequently deceived in our Eſtimates of Diſtance by any extraordinary Magnitude of Objects ſeen at the End of it: As in travelling towards a large City or a Caſtle, or a Cathedral Church, or a Mountain larger than ordinary, we think they are much nearer than we find them to be upon Trial. For ſince by Experience the Ideas of certain Quantities of known Diſtances are uſually annexed to the apparent Magnitudes of known Objects of a common Size; and ſince the apparent Magnitudes of thoſe larger Objects at a greater Diſtance are the ſame as of the ſmaller at a ſmaller Diſtance, it is no Wonder they ſuggeſt the uſual Idea of ſmaller Diſtance annext to more common Objects. This is further evident, becauſe we are ignorant of the Country, and of the Inequalities in the Ground interpoſed. Again, he obſerves, the Part of the Monument extant above the Tops of the adjoining Houſes, I am told, is five times longer than the Height of the Houſes, and yet from below that Part appears but two or three times longer at moſt; becauſe of its unuſual Magnitude and Obliquity to the Sight.” And the ſame curious Gentleman adds, “ I remember a red Coat of Arms, upon the Top of an Iron Gate at the End of a Walk, was taken for a Brick Houſe in the Fields beyond it.” *Vide Smith's Opticks, Book* I. *p.* 61, 62.

† In regard to Perception, that acute and judicious Reaſoner Mr. *Locke*, obſerves, “ We are to conſider concerning Perception, that the Ideas we receive by Senſation are often in grown People alter'd by the Judgment, without our taking Notice of it. When we ſet before our Eyes a round Globe, of any uniform Colour, *v. g.* Gold, Alabaſter, or Jet, 'tis certain, that the Idea thereby imprinted in our Mind, is of a flat Circle variouſly ſhadow'd, with ſeveral Degrees of Light and Brightneſs coming to our Eyes. But we having by uſe been accuſtom'd to perceive, what kind of Appearances convex Bodies are wont to make in us; what Alterations are made in the Reflections of Light, by the Difference of the ſenſible Figures of Bodies, the Judgment preſently, by an habitual Cuſtom, alters the Appearances into their Cauſes: So that from that, which truly is Variety of Shadow or Colour, collecting the Figure, it makes it paſs for a Mark of Figure, and frames to itſelf the Perception

“ of

reaſonable not to comply with the ſtrict Rules of Mathematical Perſpective in ſome particular Caſes (as in this before us) but to draw the Repreſentation of Objects as they appear to the Eye; and therefore, I preſume, a Painter ſhould repreſent thoſe few Objects which are an Exception to the General Rules of Perſpective, in ſuch a Manner, as may not offend the Eye of any common Spectator. For if the above Columns are to be repreſented according to the ſtrict Rules of this Art; then the Columns as they recede from the Center of the Picture will grow thick and clumſey, their Intercolumnations will be continually growing leſs and leſs, and the whole Beauty of the Building will be entirely deſtroyed.*

" of a convex Figure, and an uniform Colour; when the Idea we receive from thence, is
" only a Plane variouſly colour'd, as is evident in Painting. To which Purpoſe I ſhall here
" inſert a Problem of that very ingenious and ſtudious Promoter of real Knowledge, the lear-
" ned and worthy Mr. *Molineux*; and it is this: Suppoſe a Man born blind, and now adult,
" and taught by his Touch to diſtinguiſh between a Cube and a Sphere of the ſame Metal,
" and nearly of the ſame Bigneſs, ſo as to tell when he felt one and t'other, which is the
" Cube, which the Sphere. Suppoſe then the Cube and Sphere placed on a Table, and the
" blind Man be made to ſee: *Quære*, Whether by his Sight, before he touched them, he
" could now diſtinguiſh, and tell, which was the Globe, which the Cube. To which the
" acute and judicious Propoſer anſwers: Not. For though he has obtained the Experience
" of, how a Globe, how a Cube, affects his Touch; yet he has not yet attained the Ex-
" perience, that what affects his Touch ſo or ſo, muſt affect his Sight ſo or ſo: Or that a
" protuberant Angle in the Cube, that preſſed his Hand unequally, ſhall appear to his Eye as
" it does in the Cube. I agree with this thinking Gentleman, whom I am proud to call my
" Friend, in his Anſwer to this his Problem; and am of Opinion, that the blind Man, at
" firſt Sight, would not be able with Certainty to ſay, which was the Globe, which the Cube,
" whilſt he only ſaw them, though he could unerringly name them by his Touch, and cer-
" tainly diſtinguiſh them by the Difference of their Figures felt. This I have ſet down, and
" leave with my Reader, as an Occaſion for him to conſider how much he may be beholden
" to Experienee, Improvement, and acquired Notions, where, he thinks, he has not the
" leaſt Uſe of, or Help from them." *Vide Locke's Eſſay upon Human Underſtanding, Vol.* I. *Ch.* 9.

But this is no new Opinion, for ſo old an Author as *Lucretius*, takes particular Notice of it, for he, after having given innumerable Inſtances of the Errors in our Judgment, in regard to Sight, ſums them up in the following Lines.

Cætera de genere hoc mirando multa videmus,
Quæ violare fidem quaſi Senſibus omnia quærunt:
Nequicquam. Quoniam pars horum maxima fallit
Propter opinatus Animi, quos addimus ipſi,
Pro viſis ut ſint, quæ non ſunt ſenſibu' viſa. LUCRET. Lib. 4.

Or, as Mr. CREECH has tranſlated it:

" Ten thouſaud ſuch appear, ten thouſand Foes,
" To Certainty of Senſe, and all oppoſe:
" In vain, 'tis Judgment, not the Senſe miſtakes,
" Which fancy'd Things for real Objects takes." *Vide Creech's Lucret. B.* 4.

* Of this we have ſeveral Inſtances in *Pozzo*'s firſt Book upon Perſpective, particularly in Fig. 45, 46, 50, and 51; in which, thoſe Columns that are fartheſt from the Point of Sight, are ſo prodigiouſly increaſed in their apparent Widths, as to loſe very near one Diameter in Height; and, I think, the Diſproportion is too viſible to be diſputed, eſpecially in the 45th and 46th Figures.

What has been ſaid upon this Subject, relates only to round or cylindrical Bodies, ſuch as Globes, Columns, or the like; but as to angular ones, (eſpecially thoſe that are Square) ſince their apparent Widths are perpetually increaſed the more diagonally they are ſeen by the Eye, therefore, the Repreſentations of ſuch Objects upon the Picture ſhould continually grow larger and larger in Width the more they are removed from the Center of the Picture. Thus the Repreſentation of the Square Q, which is ſeen only in Front, cannot appear ſo large as the Repreſentation of the Square R, which is viewed as a Triangle. I ſay, that the apparent Magnitude of Objects that are Square or Triangular, will be greater when view'd Angle-wiſe, than when ſeen in Front; but the apparent Magnitude of Columns, or any other round Objects, will always be the ſame at the ſame Diſtance; becauſe, in the firſt Caſe, the Diagonal of a Square (which in ſome Views meaſures its apparent Width) is longer than its Sides; but in the latter Caſe, the Diameter of a Circle (which conſtantly meaſures its apparent Width) is always of the ſame Length; and therefore to repreſent Columns, *&c.* larger and larger, when they are at a greater and greater Diſtance, is, I preſume, falſe in Theory, (I mean in an optical Senſe only) and cannot be true in Practice. To this it may be ſaid: Why then ſhould they not be repreſented leſs and leſs in proportion to their ſeveral Diſtances, ſince in fact they are ſo? To which I anſwer again, that by a Habit of judging, and from the prevailing force of Experience, we are taught to think, they are all of the ſame Size, becauſe they are upon the ſame parallel with the Eye. Thus, for Inſtance; when we ſtand before the Middle of a Building of any conſiderable Length, we apprehend the Ends to appear exactly as high as the Middle of it, though in fact they cannot, becauſe the Angle ſubtended at the Eye from the Middle, is greater than thoſe ſubtended by the Corners. Again, ſuppoſe it was required to draw the Repreſentation of round Balls, or Globes, which are ſuppoſed to be at the ſame Diſtance from the Picture, according to the ſtrict Rules of Mathematical Projection. Then the Projection of that Ball only which is in the Eye's Axis will be a Circle, and which being properly ſhaded will appear like a Globe; but all the other Projections, which are not in the Eye's Axis, will be Eliptical, and, Shade them how you will, they can never appear like Globes to any common Spectator: I ſay to any common Spectator, becauſe ſuch Appearances contradict the common Idea which Men in general have form'd to themſelves of Rotundity. In ſhort, Perſpective, in a ſtrictly Mathematical or Optical Senſe, is one Thing; and Perſpective, according to the Acceptation of that Word among Painters, is another: The Firſt teaches how to deſcribe on a Plane, to a mathematical Exactneſs, the Projections of any Objects; but the Second, like a modeſt and judicious Maſter, teaches the moſt ſimple and general Principles of Art; and inſtead of leading us into the Mazes of Lines and Angles, and loſing us in the Labyrinths of mathematical Reaſoning, directs us only to the Study of SIMPLICITY, which is the Foundation of Grace and Beauty.

I know it may be ſaid, that if we make choice of a proper Diſtance, all Inconveniencies of this Kind may be avoided; but let the Diſtance be ever ſo proper, yet ſtill the Projections of Columns, *&c.* as they are removed farther and farther from the Center of the Picture, will grow larger and larger continually; which ſurely ought not to be admitted.

Theſe are the Reaſons which induced me to conſider this Subject in a particular Manner; but whether they are ſufficient, or not, to anſwer the intended Purpoſe, is ſubmitted to the Candour of every ingenuous Reader.

CHAP. VII.

Of AERIAL PERSPECTIVE, CHIARA OSCURO, *and* KEEPING *in Pictures.*

From Mr. HAMILTON.

“ BY AERIAL PERSPECTIVE is meant, the Art of giving a due Diminution or Degradation to the Strength of Light, Shade, and Colours of Objects, according to their different Diſtances, the Quantity of Light which falls upon them, and the Medium through which they are ſeen.

“ The CHIARA OSCURO conſiſts more particularly in * expreſſing the different Degrees of Light, Shade, and Colour of Bodies, ariſing from their own Shape, and the Poſition of their Parts with reſpect to the Eye and neighbouring Objects, whereby their Light or Colours are affected.

“ And KEEPING, is the Obſervance of a due Proportion in the general Light and Colouring of the whole Picture; that no Light or Colour in one Part, may be too bright or ſtrong for another; but that a proper Harmony amongſt them all together may be preſerved.

“ All theſe are neceſſary Requiſites to a good Picture, and may be properly enough included within the general Name of Aerial Perſpective, as they all relate to the different Degrees of Strength of the Light and Colouring, according to the Circumſtances of the Shape and Poſition of the Objects with regard to each other, the Eye, and the Light which illuminates them.

“ The Eye does not judge of the Diſtance of Objects barely by their apparent Size, but alſo by their Strength of Colour and Diſtinction of Parts; it is not, therefore, ſufficient to give an Object its due apparent Bulk, according to the Rules of Perſpective, unleſs at the ſame Time it be expreſſed with that proper Faintneſs and Degradation of Colour which that Diſtance requires.

“ Thus, if the Figure of a Man at a Diſtance were painted of a due Size for the Place, but with too great a Diſtinction of

---

* But it is the Opinion of ſome very eminent Painters, that the Words *Chiara Oſcuro*, more properly ſignify a Clearneſs of Shadow.

" Parts, or too ſtrong Colours, it will appear to ſtand forward, " and ſeem proportionably leſs, ſo as to repreſent a Dwarf ſituated " nearer the Eye, and out of the Plane on which the Painter in" tended he ſhould ſtand.

" By the ORIGINAL COLOUR of an Object, is meant that Colour " which it exhibits to the Eye when directly expoſed to it in a full, " open, uniform Light, and at ſuch a moderate ſmall Diſtance as " to be clearly and diſtinctly ſeen.

" This Colour receives an Alteration from many Cauſes, the " principal of which are theſe:

" 1. From the Object's being removed to a greater Diſtance from " the Eye, whereby the Rays of Light which it reflects are leſs vivid, " and the Colour becomes more diluted, and tinged in ſome mea" ſure with the faint blueiſh Caſt, or with the Dimneſs or Hazi" neſs of the Body of Air through which the Rays paſs.

" 2. From the greater or leſs Degree of Light with which the " Object is enlightened: The ſame Original Colour having a dif" ferent Appearance in the Shade from what it has in the Light, " although at an equal Diſtance from the Eye, and ſo in Propor" tion as the Light or Shade is ſtronger.

" 3. From the Colour of the Light itſelf which falls upon it, " whether it be by the Reflexion of coloured Light from any neigh" bouring Object, or by its Paſſage through a coloured Medium; " which will exhibit a Colour compounded of the Original Colour " of the Object, and the other accidental Colours which the Light " brings with it.

" 4. From the Poſition of the Surface of the Object, or of its " ſeveral Parts with reſpect to the Eye; ſuch Parts of it as are " directly expoſed to the Eye appearing more lively and diſtinct " than thoſe which are ſeen ſlanting.

" 5. From the Cloſeneſs or Openneſs of the Place where the Ob" ject is ſituated, the Light being much more variouſly directed " and reflected within a Room, than abroad in the open Air; " every Aperture in a Room giving an Inlet to a different Stream " of Light with its own peculiar Direction, whereby Bodies in ſuch " a Situation will be very differently affected with reſpect to their " Light, Shade, and Colours, from what they would be in an " open Place.

" 6. Some Original Colours naturally reflect Light in a greater " Proportion than others, though equally expoſed to the ſame

Degrees of it; whereby their Degradation at ſeveral Diſtances will be different from that of other Colours which reflect leſs Light.

“ From theſe ſeveral Cauſes it ariſes, that the Colours of Objects are ſeldom ſeen pure and unmixed, but generally arrive at the Eye broken and ſoftened by each other; and therefore, in Painting, where the natural Appearances of Objects are to be deſcribed, all hard or ſharp Colouring ought to be avoided.

“ A Painter, therefore, who would ſucceed in Aerial Perſpective, ought carefully to ſtudy the Effects which Diſtance, or different Degrees or Colours of Light, have on each particular Original Colour, to know how its Hew or Strength is changed in the ſeveral Circumſtances above-mentioned, and to repreſent it accordingly; ſo that in a Picture of various-coloured Objects, he may be able to give each Original Colour its own proper Diminution or Degradation according to its Place.

“ Now, as all Objects in a Picture take their Meaſures in Proportion to thoſe placed in the Front, ſo, in Aerial Perſpective, the Strength of Light, and the Brightneſs of the Colours of Objects cloſe to the Picture, muſt ſerve as a Meaſure, with reſpect to which, all the ſame Colours at ſeveral Diſtances, muſt have a proportional Degradation in like Circumſtances. But, as in Muſick, it is not neceſſary to the Harmony, that the Inſtruments ſhould be tuned to the Concert Pitch, but they may be ſet above or below it, ſo long as they are in tune to each other; ſo in Painting, it is not requiſite that the Meaſures on the interſecting Line of the Picture, or the Brightneſs of the Light there, ſhould be equal to the Life; but they may be taken greater or leſs, ſo long as every Thing elſe in the Picture bears a true Proportion to that which is choſen as the firſt Standard.

“ Hence, almoſt any Degree of Light may be taken for the greater Light in a Picture, when the leſſer Degrees of Light are expreſſed with darker or weaker Colours; for any Degree of Light may either repreſent a Light in reſpect of a darker, or it may ſerve as a Shade to a lighter; and it matters not in Point of Keeping, how light or how dark a Picture is in general, ſo that its ſeveral Parts have proportional Degrees of Light and Shade given them.

“ In order, therefore, to the giving any Colour its due Diminution in Proportion to its Diſtance, it ought to be known, what

“ the Appearance of that Colour would be, were it cloſe to the Picture, Regard being had to that Degree of Light which is choſen as the principal Light of the Picture; as in order to the giving any Object its due apparent Size, its true Size muſt be reduced to the ſame Scale with the Meaſure on the Bottom of the Picture.

“ For if any Colour ſhould be made too bright for another, or for the general Colours employed in the reſt of the Picture, it will appear too glaring, and ſeem to ſtart out of its Place, and throw a Flatneſs and Damp on the reſt of the Work; or, as the Painters expreſs it, the Brightneſs of that Colour will kill the reſt.

“ No Painting can expreſs the dazzling Brightneſs of the Sun, or even its reflected Light coming from poliſhed Metals, with that ſparkling Vivacity as it appears in the *Camera Obſcura*, in the Images of poliſhed Surfaces on which the Sun ſhines; or if it could in ſome Sort be imitated in a Picture, by the Aſſiſtance of Gilding, it would not have a good Effect with regard to the other Colours, which it would too much outſhine; and thereby hurt the Keeping: And this is one Defect which the Repreſentation of Objects in the *Camera Obſcura* is liable to; for by reaſon of the Refraction of the Rays by the Glaſs, thoſe Objects which naturally reflect leſs Light, loſe a greater Proportion of it than thoſe which reflect Light more plentifully; whereby the due Keeping in the whole, is not ſo exactly preſerved as in direct Viſion, the Lights and Shades appearing generally too ſtrong for each other.”

Thus far Mr. *Hamilton*. And I have thought proper to add the following Figure, with a Deſign of fixing what he has ſaid upon the Subject more ſtrongly in the Memory.

Fig. 109. Let E be the Eye, PP the Picture, RS, AB, CD, EF, and HL, the ſame Object ſeen by the Eye at different Diſtances; then, becauſe the farther they are removed from the Eye, the larger will be the Space of Air through which they are ſeen, and the more they will be tinged with its Hew; therefore, in Proportion as the Repreſentations Ps, Pb, *&c.* are more and more diminiſhed upon the Picture, ſo likewiſe, in the ſame Proportion, muſt the Original Colour of thoſe Objects be more and more broken and diluted with the Colour of the Air. Thus, ſuppoſe the Repreſentation Ps of RS, to be painted of the Original Colour; then, becauſe the Repreſentations Pb, Pd, Pf, and Pl, are perpetually diminiſhed in

proportion to the Diſtance of their reſpective Originals; therefore in colouring thoſe ſeveral Repreſentations, Care muſt be taken to diminiſh that alſo in the ſame Proportion.

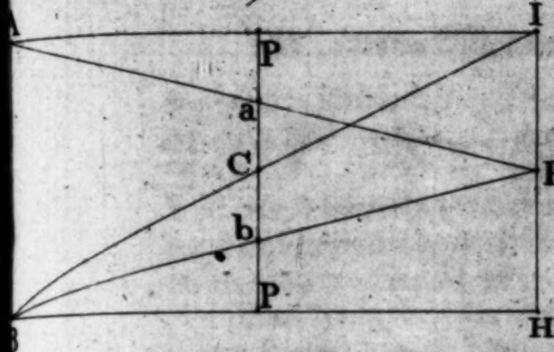
There may be ſome Exceptions made to this general Rule by a nice Obſerver of Nature, for there are ſome Incidents will happen which ſeem to contradict it; ſuch as a white Houſe, or any other very light Object directly oppoſed to the Sun at a great Diſtance; yet notwithſtanding, what has been advanced will be of great Service in fixing right Ideas of theſe eſſential Requiſites: And I may venture to affirm, that without a general Obſervance thereof, every Picture will be at beſt but a flat and lifeleſs Performance.

I might now proceed to the Conſideration of ſome other Things relative to Perſpective; but ſince they are not at all eſſential in the Theoretical Part, and as I muſt take Notice of them in another Place, I ſhall therefore put an End to this Book.

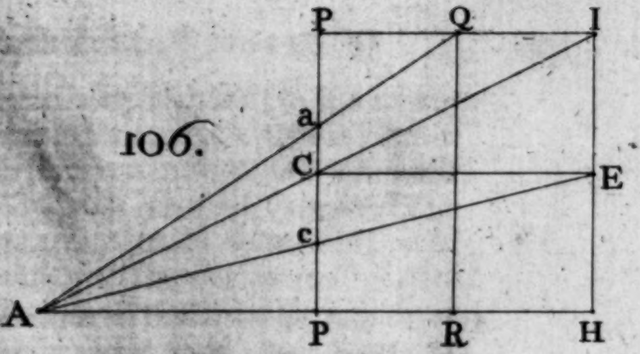
END of the FIRST BOOK.

1 JY 64

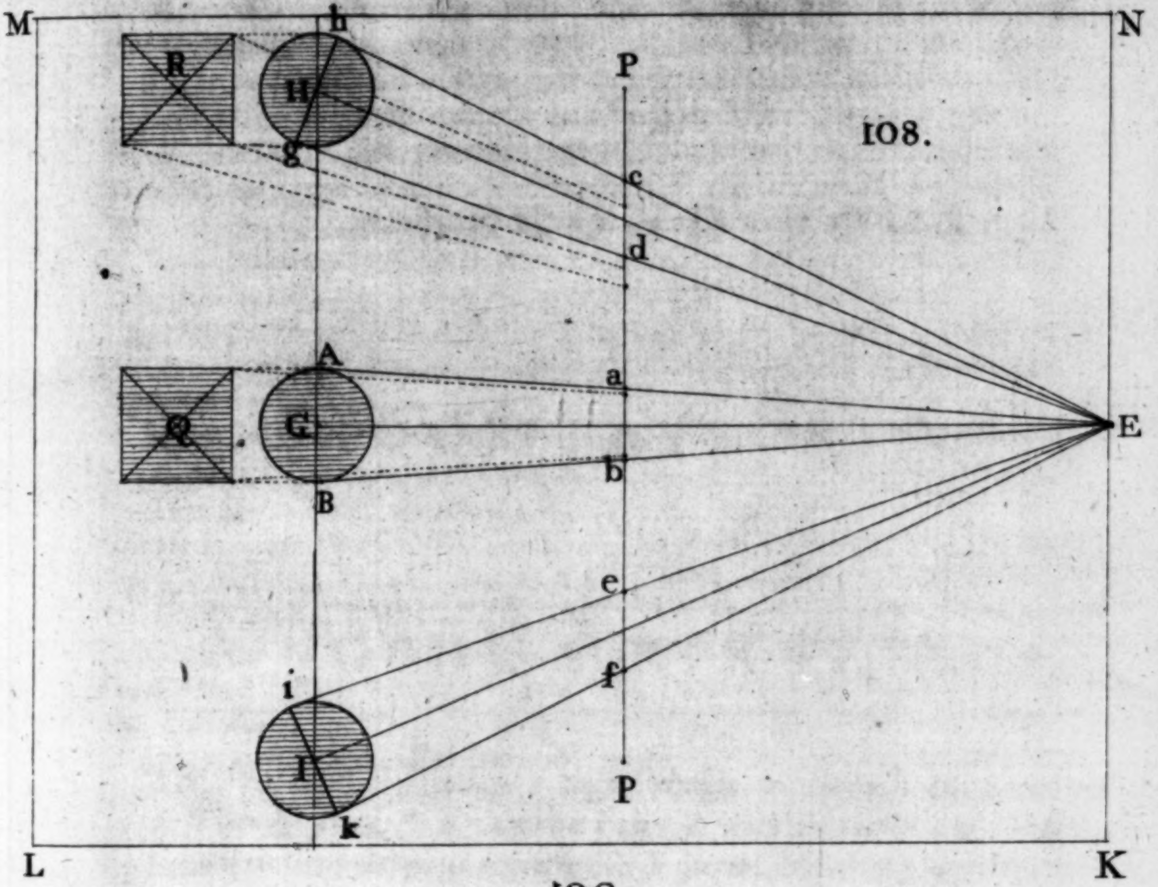
107.



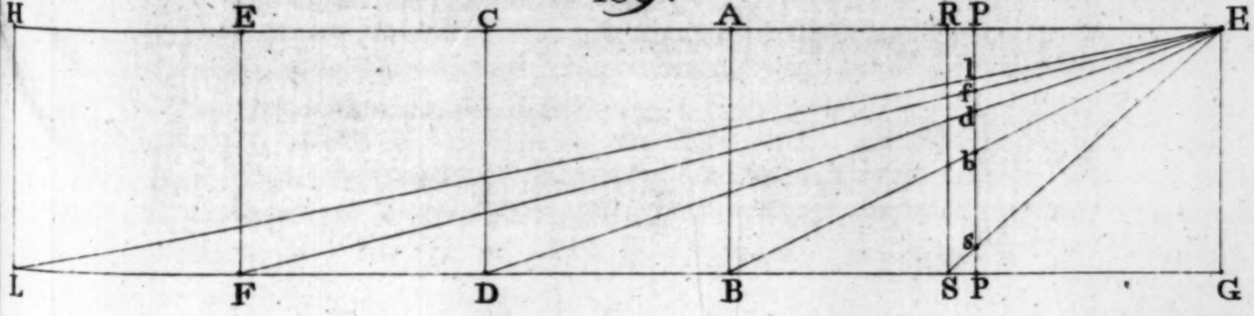
106.



108.



109.



BRITISH
1 JY64
MUSEUM

THE PRACTICE OF PERSPECTIVE:

BEING

The SECOND BOOK

OF

DR. BROOK TAYLOR's *Perſpective made Eaſy, &c.*

By JOSHUA KIRBY, Painter.

> *The Practice* [*of* Painting] *ought always to be built on a rational Theory, of which* PERSPECTIVE *is both the Guide and the Gate, and without which it is impoſſible to ſucceed, either in Deſigning, or in any of the Arts depending thereon.*
>
> Leonardo da Vinci upon Painting, p. 36.

IPSWICH:
Printed by W. CRAIGHTON. MDCCLIV.

BRITISH MUSEUM

TO THE

ACADEMY

OF

PAINTING, SCULPTURE, ARCHITECTURE, &c. in LONDON.

GENTLEMEN,

AS PERSPECTIVE is abſolutely neceſſary to a JUST DESIGN, give me Leave to dedicate this Book to You on the Subject. It is the Product of many Years Application and Study, and wrote with an Intention to render that hitherto perplexed, but uſeful Art, eaſy and familiar. How I have ſucceeded in the Attempt, is ſubmitted to your Candour and Judgment; and I hope that this Dedication will be received as an Inſtance of my Gratitude, for the Favour of that Encouragement, and Recommendation, which you have been pleaſed to give to the Work.

I do not preſume to offer any Thing *new* to the Principal Members of the Society, for I am not ſo vain as to think I can give any Inſtructions to Perſons of ſuch ſuperior Abilities; but if I can contribute a little towards inſtructing the PUPILS in the *firſt Rudiments of Deſign*, it may ſpare ſome Time and Trouble, and I hope will be accepted as a Token of my Regard for You, and Affection for thoſe ARTS.——I ſhall only add, that it is my ſincereſt Wiſh, that every Encouragement may be given to your indefatigable Endeavours, in promoting the ARTS of PAINTING, SCULPTURE, ARCHITECTURE, *&c.* That the Pupils may do Honour to their ſeveral MASTERS, and become Ornaments to their Country, and that every other Advantage may concur to raiſe the Glory of the ENGLISH ACADEMY to the higheſt Pitch.

I am,

GENTLEMEN,

Your moſt Obliged

Humble Servant,

1 JY 64

JOSHUA KIRBY.

PREFACE.

IN this Practical Book upon PERSPECTIVE *I ſhall endeavour to give ſome general Methods for finding the Repreſentations of all Kinds of Objects, however they are ſituated in regard to the Eye or the Picture, or however irregular they are amongſt themſelves. And ſince great Care has been taken to adapt every Example in this Part to the Theory, the Reader may be ſatisfied that every Figure is ſtrictly true, and capable of a Mathematical Demonſtration; ſo that thoſe whom Curioſity will not invite, or Leiſure permit, to go regularly through the preceding Theory, need not trouble themſelves about it, becauſe what follows will be ſufficient for their Purpoſe. But let them conſider, that it is in this as in all other Studies, with which, if a Perſon deſires either to be thoroughly acquainted, or to profit by his Study, he muſt* read *with* Attention, draw out *every* Figure *as he proceeds, and be* well acquainted *with one* Example *before he begins with another.*

And ſince it is preſumed that every Example in the following Work, may be as eaſily underſtood and applied to Practice by every Student in the Arts of Deſign, as are the common Principles of Arithmetick by every ordinary Mechanick; therefore it is hoped that PERSPECTIVE *will be no longer thought an abſtruſe and difficult Study, nor be diſregarded as trifling and inſignificant; but that the young* Tyroes *in the above Arts will firſt make* PERSPECTIVE *familiar to them, and treat her with the Reſpect which ſhe deſerves, as the* PARENT *of the noble Art of* PAINTING; *and upon whoſe general, though not rigid Precepts, every Deſign muſt be regulated, if the Artiſt intends it ſhall appear a* true Repreſentation of NATURE.

1 JY 64

THE
PRACTICE of PERSPECTIVE made EASY, &c.

BOOK II. CHAP. I.

An INTRODUCTION *to the* PRACTICE *of Perſpective.*

IN order to convey a general Idea of PERSPECTIVE with as much Eaſe as the Nature of the Thing will admit, let ABCD Fig. 1. repreſent a ſquare Board ſtanding perpendicularly upon the Ground, which is repreſented by HM, and ſuppoſe the Figure EH to be looking at it; then it will be evident, that he muſt ſee it by means of an infinite Number of Rays of Light, which are continually reflected from every Point of the ſaid Object to his Eye. But ſince the Rays which come from the four Corners only will be ſufficient for our Purpoſe, we will ſuppoſe that he ſees it by means of the four Lines AE, BE, CE and DE, which repreſent thoſe four Rays of Light: And, if we ſuppoſe a tranſparent Plane, like a large Piece of Glaſs, to be placed between the Object ABCD and the Spectator's Eye, it muſt be obvious, that this Plane will cut the Rays of Light in their Paſſage to his Eye. Now, the Shape abcd, which that Cutting of the Picture makes with the Rays, is called *the Projection of the real Object* ABCD, upon the Glaſs. And if inſtead of this tranſparent Plane, we ſuppoſe GLOP to be a Canvas, and the above Projection to be drawn upon it in the very ſame Manner as it was projected upon the Glaſs, then the Figure ſo deſcribed is called *the Perſpective Appearance of the real Object* ABCD; for the Rays of Light coming to the Eye from the Points a, b, c, d, which are drawn upon the Picture, in the very ſame Manner as they do from the corresponding original Points A, B, C, D, of the real Figure; therefore, if they are painted with the ſame Strength of Colour, *&c.* they will to the Spectator E H, appear like that original Object: So that the whole Art of Perſpective conſiſts, in determining theſe, and the like Appearances, upon the Picture, and in giving them their proper Force and Colour.

Now let us obſerve, *Firſt,* If the original Figure be parallel to the Picture, then its Repreſentation will be exactly like it; thus, ABCD is parallel to the Picture, therefore, a b c d, its Repreſentation, is exactly like it. For which Reaſon, the Repreſentations of all Objects that are parallel to the Picture, will not tend to any Points upon the Picture, but will be parallel amongſt themſelves, and only proportionally diminiſhed as their Diſtance from the Eye is greater or leſs: But the Repreſentations of all Objects that are not parallel to the Picture, will vaniſh into various Points upon the Picture, which, are therefore called, *the vaniſhing Points of ſuch Objects.*

Fig. 2. *Secondly,* The Projections AB c d and e f g h, of the Squares ABCD, EFGH, which lie flat upon the Ground, HM, will to the Spectator, EH, be the perſpective Appearance of thoſe Objects: And the Repreſentations of the Sides AB, cd, eh and f g, will be parallel to the Bottom of the Picture, but will be ſeverally diminiſhed in proportion to their Diſtance from the Picture. Thus AB is even with the Bottom of the Picture, and therefore its Repreſentation is the ſame as the original Line AB, and conſequently equal to it: But the Repreſentations cd, eh, and fg, will be perpetually diminiſhed in the Degree of Diſtance they are from the Picture; as is evident by inſpecting the Figure. For which Reaſon, the Repreſentations Ad, Bc, ef, and gh, of Lines AD, BC, EF, and GH, which lie flat upon the Ground, and are parallel amongſt themſelves, but not parallel to the Picture, will continually approach towards each other, 'till they vaniſh into a Point C, exactly as high above the Bottom GL of the Picture, as the Eye is removed above the Ground HM. Thus, F C is equal to the Height of the Eye EH, and the Sides Ad, Bc, *&c.* will vaniſh into the Point C. From hence then, we ſee the Reaſon why the Repreſentations of Objects are more and more diminiſhed upon the Picture, the farther thoſe Objects are ſuppoſed to be from it.

Thirdly, We have obſerved that the Repreſentations Ad and Bc, of the oblique Sides AD and BC of the real Object, will vaniſh into the Point C upon the Picture; and therefore the Point C may very properly be called the vaniſhing Point of the Lines AD and CB.

BC.—Now, in order to determine the vaniſhing Point of any Line, we muſt always draw a Line from the Eye parallel to that Line: Thus EC is parallel to AD, or BC, and therefore, C, where EC cuts the Picture, is the vaniſhing Point of AB, or BC.

And in like Manner, EJ being drawn parallel to the Line BK, Fig. 1. which is oblique with the Ground, will give J for its vaniſhing Point upon the Picture. For, from K draw the Ray KE to the Eye, which will cut the Picture in K; then is k the Repreſentation of K, and b is the Repreſentation of B; therefore, kb is the Repreſentation of KB: And, if kb was continued upwards upon the Picture, it would cut EJ in the Point J, and therefore J is its vaniſhing Point.

Fourthly, If thro' the vaniſhing Point C, a Line HL be drawn parallel to the Bottom of the Picture, then that Line will be the vaniſhing Line of all Objects that lie flat upon the Ground, or are parallel to it. Now this Line, HL, hath always been called the Horizontal Line, and therefore, I ſhall call it by that Name in the following Work. Indeed, it is the moſt uſeful of all vaniſhing Lines; but nevertheleſs, too much Streſs hath been laid upon it by almoſt all Writers upon this Subject; who have paid no Sort of Regard to any other vaniſhing Lines. But had they conſider'd, that there are ſeveral Objects whoſe Repreſentations cannot be correctly determined upon the Picture, without a general Knowledge of all Kinds of vaniſhing Lines and vaniſhing Points, they would not have confined themſelves to the Horizontal Line only; and had they built their ſeveral Syſtems of Perſpective upon as ſolid Principles as Dr. *Taylor* or Mr. *Hamilton*, their Works would not have been crouded with ſuch a Confuſion of Lines, nor with ſuch a Number of uſeleſs Examples; but they would have been more *true*, *ſimple*, and of more *general Uſe*. But to return from this Digreſſion.

Fifthly, Since the Horizontal Line is level with the Eye and parallel to the Ground, and, for that Reaſon, the vaniſhing Line of all Objects which lie flat upon the Ground, or are parallel to it; ſo, for the very ſame Reaſon, the vaniſhing Line of any other Object will be parallel to that Object. Thus, ſuppoſe ABK to be a trian- Fig. 1. gular Plane, which ſtands upon the Edge AK, perpendicular to the Ground: Then the vaniſhing Line of this perpendicular Plane will be perpendicular to the Horizontal Line; and if this Plane be perpendicular to the Picture alſo, then its vaniſhing Line will paſs through the Center of the Picture; thus JF is the vaniſhing Line of ABK.

Thus much, I preſume, may ſuffice to give the unlearned Reader a tolerable Idea of Perſpective.—We will now give an Explanation of a few Terms made uſe of in the following Work, and then proceed to the Mechanical Part of Perſpective.

DEFINITIONS.

1. THE *Point of Sight*, is that Point where the Spectator's Eye is placed to look at the Picture.—Thus E is the Point of Sight. Fig. 1.

2. If from the Point of Sight E, a Line EC is drawn from the Eye perpendicular to the Picture, then the Point C, where that Line cuts the Picture, is called *the Center of the Picture*.

3. *The Diſtance of the Picture*, is the Length of the Line EC, which is drawn from the Eye perpendicular to the Picture.

4. If from the Point of Sight E, a Line EC be drawn perpendicular to any vaniſhing Line HL, or JF, then the Point C, where that Line cuts the vaniſhing Line, is called *the Center of that vaniſhing Line*.

5. *The Diſtance of a vaniſhing Line*, is the Length of the Line EC, which is drawn from the Eye perpendicular to the ſaid Line: And if PO was a vaniſhing Line, then EJ will be the Diſtance of that Line.

6. *The Diſtance of a vaniſhing Point*, is the Length of a Line drawn from the Eye to that Point: Thus, EC is the Diſtance of the vaniſhing Point C, and EJ is the Diſtance of the vaniſhing Point J.

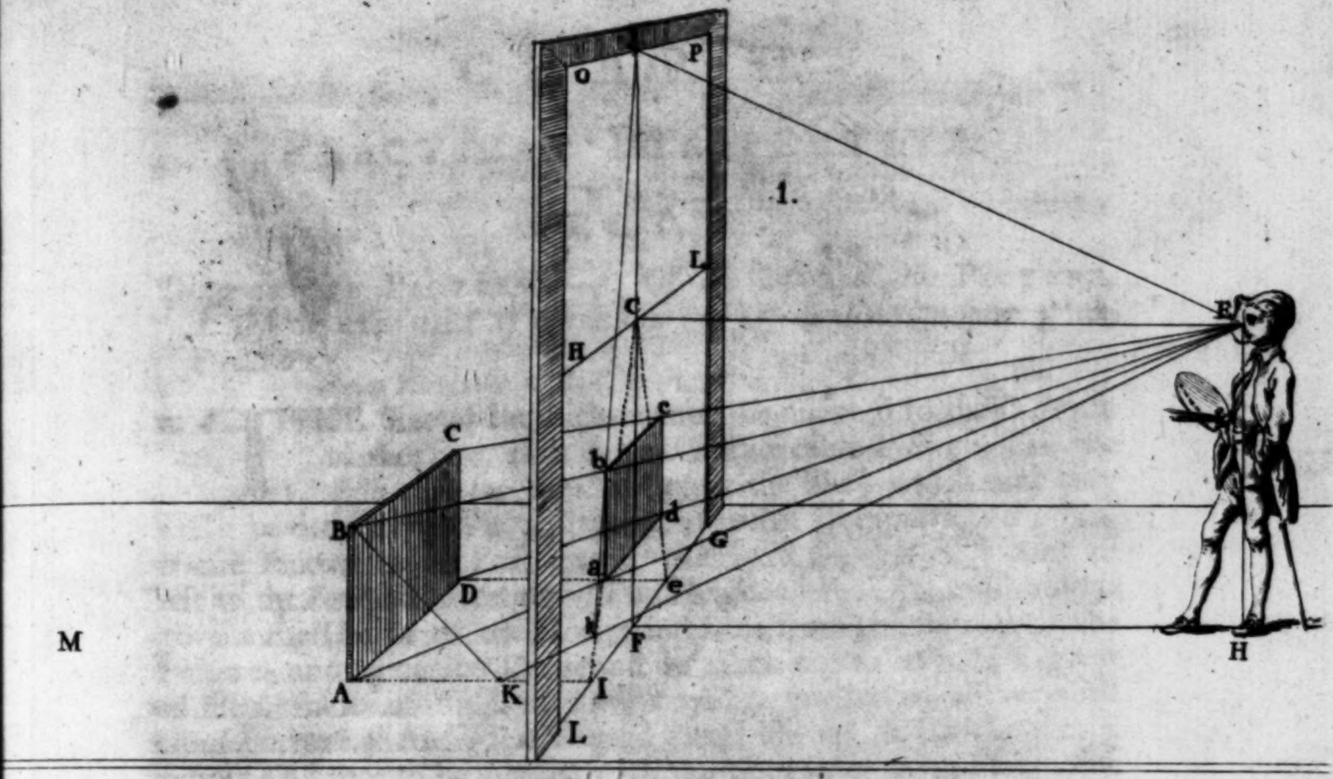
7. By *Original Object*, is meant the real Object whoſe Repreſentation is ſought: And by *Original Plane*, is meant that Plane upon which the real Object is ſituated: Thus, the Ground HM is the Original Plane of ABCD, &c. Fig. 1, 2.

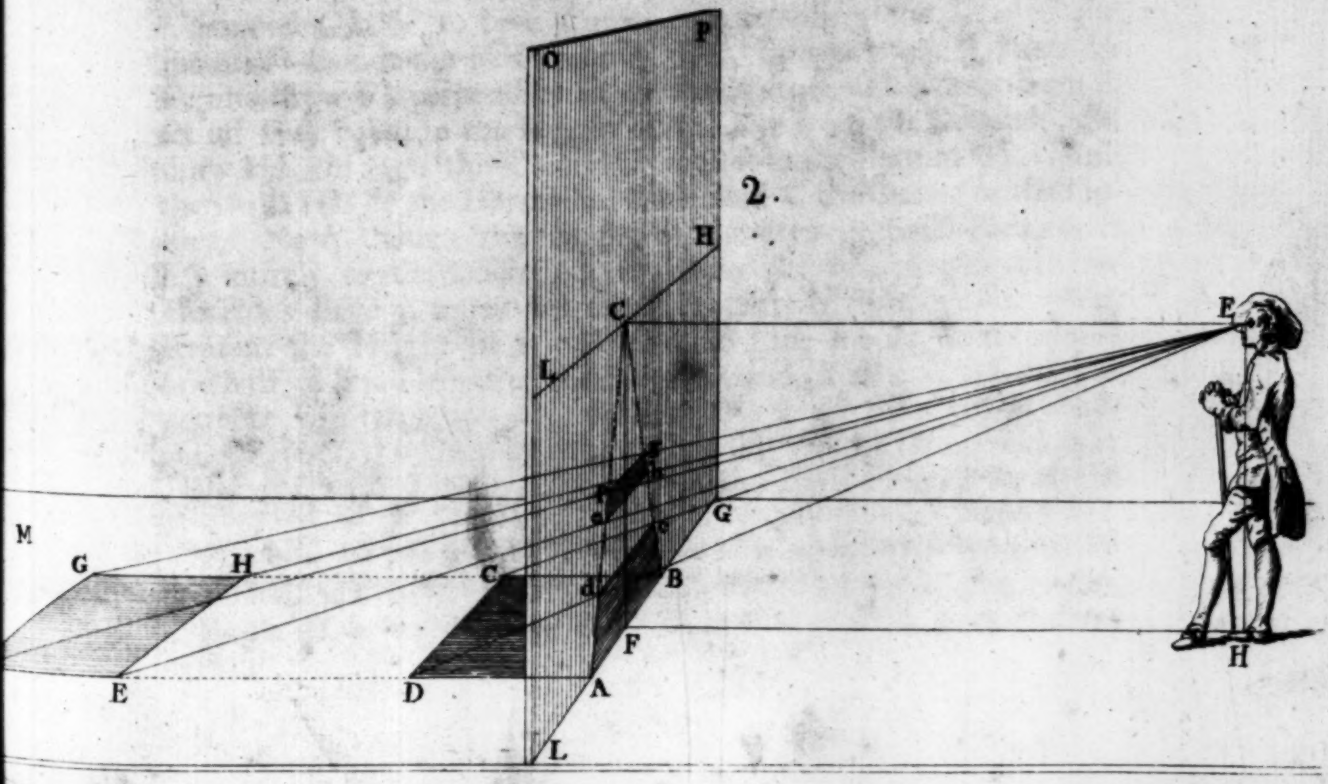
AXIOMS.

Fig. 2. 1. The Repreſentations of all Lines that are parallel to each other, but not parallel to the Picture, will have the ſame vaniſhing Point: Thus, the Repreſentations Ad, Bc, of the parallel Lines AD, BC, have the ſame vaniſhing Point C.

2. The Repreſentations of all Lines that are parallel to each other, and parallel to the Picture alſo, will not vaniſh into any Point upon the Picture, but will be parallel to each other: Thus, AB, cd, eh, and fg, are parallel to each other, becauſe the Originals AB, CD, EH, and GF, of thoſe Lines, are parallel to each other.

CHAP.


O
P
1.
L
C
E
H
c
C
b
d
B
G
a
D
e
M
k
F
H
A
K
I
L


O
P
2.
H
C
E
L
g
f
h
e
c
G
M
G
H
C
d
B
F
E
D
A
H
L

BRITISH
1 JY64
MUSEUM

CHAP. II.

PRACTICAL PERSPECTIVE.

SECT. I.

To prepare the PICTURE.——1. *Of the* SIZE *of the* PICTURE. 2. *Of the* HEIGHT *of the* EYE. 3. *Of the* DISTANCE *of the* PICTURE.

1. THE Size of the Picture muſt be adapted to the Diſtance of the Eye, if it be an immoveable Picture, like the Side of a Room, Ceiling, or the like; which may very eaſily be done by means of Frames, or other Compartments: But, if the Picture be an Eaſel-Piece,* then the Bigneſs of it may be left to the Artiſt's Diſcretion. The Height of the Eye, muſt always govern the Height of the Horizontal Line from the Bottom of the Picture; and particular Care muſt be taken not to let it be ſo great as the Diſtance of the Eye, ſince it will be productive of very bad Conſequences. And great Regard muſt be had to the chooſing a proper Diſtance to be worked with, for otherwiſe, every Perſpective Repreſentation will have a very bad Effect.

2. *For the* HEIGHT *of the* EYE.

Suppoſe GLTP to be a Canvas, repreſenting the Size of the Picture.—Divide the Bottom of it, GL, into two equal Parts in F, and draw FI perpendicular to the Bottom GL; then from F ſet off FC, equal to the Height of the Eye from the Ground, and draw HL through the Point C, parallel to the Bottom GL: And then will HL be the Horizontal Line, and C the Center of the Picture. Now, though the Height of the Eye in Eaſel-Pictures is left intirely to the Diſcretion of the Artiſt; yet, in general, low Horizons have a much better Effect than high ones; for which Reaſon, the Height of the Horizontal Line ſhould never exceed one half of the Height of the Picture; and, I believe, a little Experience will teach any one, that if it is made equal only to one third Part of the Height of the Picture, it will be the moſt proper Height of any; I mean only in regard to Eaſel-Pieces; for if the Fig. 3.

---

* The Inſtrument upon which a Picture is placed to be painted, is called an *Eaſel*; and therefore, every Picture which is moveable, is called an *Eaſel-Piece*.

Picture be a fixed one, then the Height of the Horizontal Line muſt be exactly level with the Spectator's Eye.

3. *For the* DISTANCE *of the* EYE.

The chooſing a proper Diſtance for the Eye is ſuch an eſſential Requiſite, that without a nice Obſervance thereof, every Perſpective Repreſentation will appear a ſhocking Deformity; therefore, we ſhall be the more particular in ſettling a proper Diſtance for the Eye; the Neceſſity of which will appear by the following Example.

In the 4th Figure I ſuppoſe ABED a real Square upon the Ground, and CE one Diſtance of the Eye, and CI another. Now, by putting this Square into Perſpective, agreeable to thoſe different Diſtances, we ſhall have abED for the Repreſentation of the Square as ſeen at the Diſtance CE, and EDcd for the Repreſentation of the Square as ſeen at the Diſtance CI; and by inſpecting the Figure, we may perceive, that the Repreſentation EDcd, which is ſeen by the Eye at the Diſtance CI, does not appear like a Square, but looks much longer than 'tis wide, and therefore, it is a falſe Repreſentation; but the Repreſentation abED, which is ſeen by the Eye at the Diſtance CE, has a more agreeable Appearance, and looks like a Square ſeen in Perſpective, and therefore is a more juſt Repreſentation. Now, that this Difference between the two Repreſentations of the ſame Object is wholly owing to the different Diſtances of the Eye, is apparent from the Figure; and therefore, this one Inſtance, out of many, many ſuffice to ſhew the Neceſſity of chooſing a proper Diſtance to be worked with: In order to do which, the following Method ſeems the moſt eaſy, and the moſt uſeful, of any I can think of.

Fig. 3. Having drawn the horizontal Line HL, and fixed the Center C, of the Picture; draw a Line (as CP) from the Center C, to one of the fartheſt Corners (as P) of the Picture; draw alſo the Perpendicular CD, and continue it at pleaſure; then from C, ſet off the Length CP, upon CE, and call CE the leaſt Diſtance: Again, from C, ſet off CD, upon the Line CD, equal to the longeſt Dimenſions of the Picture, and call CD the greateſt Diſtance. That is, never let the Diſtance you work with be greater than CD, nor leſs than CP; becauſe, as was obſerved before, if the Diſtance be leſs than CE, the Repreſentations will be too deep; and if it be more than CD, the Repreſentations will not be deep enough; and, I think, if a Medium between theſe two Diſtances be taken as a

general Rule, it will produce the moſt agreeable Shape of any Diſtance whatſoever. Thus, the Repreſentation E D m n, (Fig. 4.) is determined by ſuch a Diſtance.

In this Place it may not be improper to take Notice, that the Diſtance of the Picture is ſometimes placed upon a Line as CD, Fig. 3. perpendicular to the horizontal Line, and ſometimes upon the horizontal Line itſelf; as the Nature of the Work may require. And I will alſo obſerve, that the Diſtance generally made uſe of in this Work, is the leaſt Diſtance, for the Conveniency of having as many Figures upon each Plate as was poſſible. And the Reader is deſired to remember, that the Letters CE will always ſtand for the Diſtance of the Eye, E for the Eye, or Point of Sight, C for the Center of the Picture, HL for the horizontal Line, and GL for the Ground Line, or Bottom of the Picture. For, to avoid Prolixity, I ſhall not mention either of thoſe Terms but upon ſome particular Occaſion. And that he may fix them the eaſier in his Memory, I have made every Letter as ſignificant as poſſible: Thus E is the Eye, C the Center, HL the horizontal Line, &c. And I ſhall, moreover, always ſuppoſe a Picture, as GLTP, (which may be conſidered as a large Picture in Miniature) to be laid flat upon the Ground, and that we are actually at work upon it, in determining the Repreſentation of the following Figures.

SECT. II.

Of OBJECTS *which lie flat upon the* GROUND, *or that are in Planes perpendicular to the Picture.*

I. *To find the Repreſentation of a Point upon the Picture, after having prepared the Picture as above directed.*

METHOD 1. *By one vaniſhing Point only.*

LET A be the Point upon the Ground.—From A draw any Line at Pleaſure, as A1, cutting the Bottom of the Picture in 1; Fig. 5. and from the Eye E, draw EL parallel to A1, cutting the horizontal Line in L; then is L the vaniſhing Point of A1; therefore, draw the Line L1, then from the Point A, draw a Line to E, cutting L1, in a; and then is a, the Repreſentation of the original Point A.

METHOD 2. *By two vaniſhing Points.*

Draw A1, A2, at pleaſure, cutting the Bottom of the Picture in 1 and 2, and from the Eye E, draw EL parallel to A1, and

EH parallel to A 2; then draw L 1 and H 2, which will cut each other in a, and ſo give a, for the Repreſentation of A.

Fig. 6, & 2. II. *To find the Repreſentation of a Line* AB, *which is perpendicular to the Bottom of the Picture.*

Method 1. *By one vaniſhing Point.*

Let AB be the real Line upon the Ground.---Now ſince AB is perpendicular to the Bottom of the Picture, therefore EC is parallel to it; and therefore C, where EC cuts the horizontal Line, is the vaniſhing Point of AB.---Draw AC, and from B draw BE, cutting AC in b; and then is Ab the Repreſentation of AB.

Method 2. *By two vaniſhing Points.*

From B draw B 1 at pleaſure, cutting the Bottom of the Picture in 1, and from the Eye E, draw EH parallel to B 1, cutting the horizontal Line in H; then is H the vaniſhing Point of B 1; therefore draw 1 H, cutting AC in b; which will determine the Repreſentation propoſed.

In like manner, the Repreſentation Fd, of FD, which lies directly againſt the Middle of the Picture, is to be determined. For C is the vaniſhing Point of FD, and H is the vaniſhing Point of D 2.

From hence then we may conceive, that if there were ever ſo many Lines parallel to AB, they would all vaniſh into the Center of the Picture; and that the Repreſentation Fd, of any Line that lies directly againſt the Middle of the Picture, will be perpendicular to the Bottom of the Picture; that is, will be Part of the Perpendicular FC, which is drawn from F to the Center C; but in proportion as any other perpendicular Lines (as AB) are more and more removed from the Middle F, the Repreſentations Ab of ſuch Lines will be more and more oblique with the Bottom of the Picture.

III. *Of a Line parallel to the Bottom of the Picture.*

Method 1. *By one vaniſhing Point.*

Fig. 7. Let AB be the Original Line.---Draw A 1, B 3, perpendicular to the Bottom of the Picture; then is C their vaniſhing Point; therefore draw 1 C, 3 C; and from the Extremities of the Line AB draw Lines (as AE) to the Eye, cutting 1 C, 3 C, in a and b; then draw ab, which will be the Repreſentation of AB.---Or it may be done by finding one End only of the Repreſentation (as a) and then drawing ab parallel to the horizontal Line, 'till it cuts 3 C.

Method 2. *By two vaniſhing Points.*

Draw A2, B4, at pleaſure, (but parallel to each other) cutting the Bottom of the Picture, as before: Then draw EH parallel to A2; and then is H the vaniſhing Point of A2 and B4; therefore draw 2H, 4H, cutting 1C and 3C in a and b; finally, draw the Line ab, which is the Repreſentation propoſed.—Or, finding one Point only (as a) and then drawing ab parallel to the horizontal Line, as before, will be ſufficient.

IV. *Of a Line* AB *oblique with the Bottom of the Picture.* Fig. 8.

Method 1. *By one vaniſhing Point.*

Continue AB to the Bottom of the Picture, and draw EH parallel thereto; and from 3 draw 3H; then from the Extremities A and B draw Lines to E, which will cut 3H in a and b; and then is ab the Repreſentation of AB.

Method 2. *By two vaniſhing Points.*

From the Extremities AB draw A1, B2, parallel to each other; and from E draw EL, parallel to A1, B2; then draw 1L, 2L, cutting 3H in a and b; and then is ab the Repreſentation of AB.

Here let us obſerve, that ſince Lines muſt be either perpendicular to the Picture, parallel to the Picture, or oblique with the Picture, the three laſt Examples may ſerve as univerſal Rules for the Situation of all Objects that are ſuppoſed to lie upon the Ground; which is fully explained in the following Figures.

V. *Of an equilateral Triangle,* one of whoſe Sides is parallel to the Picture.*

Method 1. *By having the Original Figure* ABD *drawn out upon the Ground.* Fig. 9.

Continue BA and BD to the Bottom of the Picture, and draw EL parallel to AB, and EH parallel to BD; then draw 1L and 4H, cutting each other in b; and then is b the Repreſentation of the Angle B. Again, from D draw D3 parallel to B1; then is L its vaniſhing Point; therefore draw 3L, cutting 4H in the Point d; and then is d the Repreſentation of the Angle D: And ſince AD is parallel to the Bottom of the Picture, therefore, if from the Point d, the Line ad be drawn parallel to the Bottom of the Picture, it will compleat the Repreſentation propoſed.—Or, it may be done by drawing A2 perpendicular to GL, and then drawing 2C, cutting 1L in the Point a.

---

* An Equilateral Triangle is that whoſe Sides and Angles are all equal.

METHOD 2. *By making an Angle at the Eye E, equal to the given Angle* ABD.

Let ab be one Side of the Repreſentation given upon the Picture.—Continue ab to the horizontal Line; then is L its vaniſhing Point: From L draw LE to the Eye; and any where a-croſs the Line CE, draw ef parallel to the horizontal Line, and then make ef equal to fE: Again, draw EH through the Point e, and then is H the vaniſhing Point of the Side bd; therefore, thro' b draw bd, and from a, draw ad parallel to the horizontal Line; which will compleat the Repreſentation.—Or it may be done thus: Having continued ab to its vaniſhing Point L, and having drawn LE, make an Angle at the Eye E equal to 60 Degrees*, and draw EH, which will cut the Horizontal Line in the vaniſhing Point of the other Side bd.

METHOD 3. *Without having any Original Figure drawn but, but by having one Side given only.*

Let ab be the Side given.—Continue ab to its vaniſhing Point L, and draw LE; then at L, with the Diſtance LE, deſcribe the Arc EH, cutting the horizontal Line in H; then is H the vaniſhing Point of the other Side bd; and by drawing ad parallel to the horizontal Line, the Repreſentation will be compleated.

Here let the Reader obſerve again, that if the Diſtance LE, of any vaniſhing Point L, be tranſferred unto the Horizontal Line, as LH, it will cut off one Line equal to another Line given. Thus, let ba be a given Line.—From a, draw ad parallel to the horizontal Line; and from H (the Diſtance of L from the Eye E) draw Hd through the Point b, cutting ad in d; then is ad equal to ab; for they are both the Repreſentations of two Sides AB, AD, of a Triangle ABC, whoſe Sides are all equal.—In like Manner, if ad was a Line given, and L the vaniſhing Point of a Line ab, which is required to be cut off equal to ad: Then make LH equal to LE; and from d, draw dH, cutting aL in b; and then is ab equal to ad.†

---

* This Angle may be ſet off with an Inſtrument call'd a Protractor, which is a Semi-Circle divided into 180 equal Parts, called Degrees.

† The Learner cannot make this Figure too familiar to him, as 'tis of prodigious Uſe.

VI. *Of an Equilateral Triangle* ABC, *whoſe Sides are all oblique with the Picture.* Fig. 10.

METHOD 1. *By having the Original Figure drawn out upon the Ground.*

Continue the Sides of the Triangle to the Bottom of the Picture, as 1, 2, 3, and draw EI parallel to AC, EF parallel to AB, and EK parallel to BC, which will ſeverally cut the horizontal Line in the vaniſhing Points of AB, AC, and BC; therefore, from thoſe vaniſhing Points draw Lines to 1, 2, 3, and their mutual Interſections a, b, c, with each other, will give the Repreſentation abc of the original Triangle ABC.

METHOD 2. *By making Triangles at the Eye, as before.*

Let ab be one Side of the Repreſentation given.—Continue it to its vaniſhing Point F, and draw FE; then at E, upon the Line EF, make the equilateral Triangles MEN, MEO; continue EN and EO 'till they cut the horizontal Line, which will give the vaniſhing Points required; therefore from a, draw aI, and thro' b draw Kc, which will compleat the Repreſentation abc.

METHOD 3. *By giving one Corner* a, *of the Triangle, and from thence finding the whole Repreſentation* abc.

From a, draw aF, and call F one vaniſhing Point; then from F draw FE, and at E make an Angle of 60 Degrees, and draw EI; then draw Ia, and through a, draw fe, parallel to the horizontal Line, at pleaſure, and make af, ae, each equal to one Side of the ſuppoſed Repreſentation; then from the vaniſhing Point I, ſet off the Diſtance IE to D; and from e, draw eD cutting aI in c; then is ac equal to ae. Again, from F ſet off the Diſtance FE, (as FP) and draw fP, cutting aF in b; then is ab equal to af; finally, draw bc, which will compleat the Repreſentation abc.

VII. *Of a Geometrical Square* ABCD, *having one Side* AB *parallel to the Picture.* Fig. 11.

METHOD 1. *By a Plan; that is, by having the Original Square drawn out upon the Ground.*

Draw AC, BC, to the vaniſhing Point C, of the perpendicular Sides AD, BC; and from the Eye E, draw EH and EL parallel to the Diagonals BD and AC; then from A and B draw Lines to L and H, cutting AC in d, and BC in c; then draw dc, which compleats the Repreſentation.—Having found the Repreſentation of one Square, any other Square, as i k, may be found alſo. For let i k be one Side of the Repreſentation given.——From i and k draw iC and kC; then from i draw iL, and from k draw kH; which will give the Depth of the Square, as in the Figure.——Or, one Diagonal only will be ſufficient. Thus, AL cuts BC in c; therefore draw c d parallel to the horizontal Line.

From hence we may obſerve, that when original Squares are thus ſituated, the vaniſhing Points H and L of their Diagonals, are exactly as far from the Center of the Picture, as the Eye is from the Center of the Picture. Thus HC and LC are each equal to the Diſtance CE; and therefore, by ſetting off CH, or CL, equal to CE, the Lines EH and EL may be omitted.

METHOD 2. *By having only the Depth* FI *of the Square* FIL *given.*

Set off IL and I1, equal to the Depth FI.——From I and L draw Lines to C, and make CL equal to CE; then draw 1L, cutting 1C in f; then is If cut off equal to I1; therefore draw fe parallel to the horizontal Line, and the Repreſentation will be compleated.

METHOD 3. *By having only one Side, as* GK, *given.*

From G and K, draw Lines to C; continue GK, and make K2 equal to GK; then make CH equal to CE, and draw H2, cutting KC in b; finally from b, draw ab parallel to the horizontal Line, and the Thing propoſed is done. In like manner any other Square, mno, may be found.

VIII. *Of a Geometrical Square, when its Sides are oblique with the Picture.*

Fig. 12.

METHOD 1. *By a Plan* ABCD.

Parallel to the Sides AB, CD, AD, BC, draw EL and EH; then are L and H the vaniſhing Points of thoſe Sides; for continue the Sides of the Square 'till they cut the Bottom of the Picture in 1, 2, 3, 4; then from 1 and 2, draw Lines to H, and from 3 and 4, draw Lines to L, and their mutual Interſections a, b, c, d, will give the Repreſentation propoſed.——Or the original Square may be made at the Eye, as in the Figure.

METHOD

METHOD 2. *By having only one Side, as* Gi, *given upon the Picture.*

Continue Gi till it cuts the horizontal Line in H, and from H draw HE; then at E, make a right Angle [*] with the Line HE, and draw EL; then is H the vaniſhing Point of the Sides Gi, lk, and L is the vaniſhing Point of the Sides Gl and ik; therefore, from G and i draw GL and iL, then from G draw GC, cutting Li in k; finally, from H draw a Line through k, cutting Gl in l, and then is Gikl the Repreſentation propoſed.

METHOD 3. *By having only the Length of the Diagonal* eL *given upon the Bottom of the Picture, as* LP.

From L draw LC; then from P draw PH, cutting LC in e; then is Le the Repreſentation of the Line LP: Again, from L draw LL, cutting PH in f, and from L draw LH, then thro' h draw Lh, cutting LH in h; and then ſhall we have the Repreſentation Lfeh.

IX. *To find the Repreſentation of a Square,* abcd, *of any determinate Width; ſuppoſe three Feet.*

Fig. 13.

Let a be one Corner given, and K the vaniſhing Point of the Side ad.---Make KD equal to KE, and from D draw a Line thro' a, cutting the Bottom of the Picture in f; then from f, on the Side of ad, ſet off three Feet upon the Bottom of the Picture, and from e draw eD, cutting aK in d; then is ad equal to three Feet: Again, from K draw KE, and make a right Angle at E, then draw EL; and then is L the vaniſhing Point of the Side ab; therefore draw aL, and biſect [†] the Angle KEL, and draw EB cutting the horizontal Line in B; then is B the vaniſhing Point of the Diagonal of the Square; by which means the whole Figure may be compleated. For draw aB and dL, cutting it in c, then draw Kb through the Point c; and then is abcd the Square propoſed.

---

[*] A right Angle is one Corner of a Square, or 90 Degrees.

[†] Biſect, is to divide any thing into two equal Parts: Thus, on E deſcribe any Arc, OQP, then divide that Arc, in Q, into two equal Parts, and draw EB, and then is the Angle KEL biſected.

X. *Of a regular Hexagon**, *having one of its Sides parallel to the Picture.*

Fig. 14. METHOD 1. *By a Plan* ABCDEF.

Continue the ſeveral oblique Sides 'till they cut the Bottom of the Picture, and draw EH and EL parallel thereto; then will L be the vaniſhing Point of AB and DE, and H will be the vaniſhing Point of BC and EF; therefore, through the Corners A, D, and F, C, draw D2, C5, which being parallel to the Sides AB, EF, will have H and L for their vaniſhing Points; and therefore, from 1 draw 1H, and from 3 draw 3L, cutting each other in b; then is b the Repreſentation of the Corner B. Again, from 2 draw 2H, cutting 3L in a; then is a the Repreſentation of the Corner A, and ab is the Repreſentation of the Side Ab; therefore, draw 4H and 5L, and then is f the Repreſentation of F; then draw af, which will be the Repreſentation of AF; finally, draw 6L, which will cut 4H in e, and give the Repreſentation of EF; and ſo on.—Here the Learner may take Notice, that this whole Repreſentation is found in the ſame Manner as the ſingle Point A, Fig. 5; only the Operation in this Figure is repeated ſix times, becauſe here are ſix Points, which repreſent ſix Corners, inſtead of one.

METHOD 2. *By having one Side* ab, *in the Repreſentation given.*

Through the Corner a, draw a Line fh, parallel to the horizontal Line, and continue ab to its vaniſhing Point L; then from L draw LE, and make LH equal to LE; and from H draw a Line through b, cutting ah in h; then is ah equal to ab; therefore make af equal to ah; and then is af the Repreſentation of the parallel Side AF: From f draw fL, and from a, draw aC, cutting fL in c; then is c another Corner; therefore draw bc, which repreſents another Side; then from c draw cd, parallel to the horizontal Line, and draw fC cutting it in d; then is d another Corner, and cd another Side; finally, through d draw Le, and from f draw fH, which compleats the Repreſentation.

Fig. 15. In like Manner the Repreſentation of an Octagon (or eight-ſided Figure) ABCDEFGH, is to be determined.—I have put every

---

* A Hexagon is a ſix-ſided Figure; and when its Sides are all equal, it is called a regular Hexagon.

Line and Point uſed in the Operation, which, it is preſumed, is now ſufficient, without any further Explanation.

XI. *To find the the Repreſentation of the Circle* ABC. Fig. 16.

METHOD 1. *By finding the Repreſentation of ſeveral Points, as* A, B, C, *&c.*

From theſe Points draw any Lines at pleaſure, but parallel to each other, as C1, C2, B3, B4, *&c.* cutting the Bottom of the Picture; then find their vaniſhing Points, as H, L, and from each original Section at the Bottom of the Picture, draw Lines to their reſpective vaniſhing Points, and their ſeveral Interſections will give the Repreſentations of the original Points; from whence the Repreſentation of the Circle may be drawn by hand: Thus a, b, c, are the Repreſentations of A, B, C, *&c.* This alſo is a Repetition of Fig. 5.

METHOD 2. *Or the Repreſentation of a Circle may be found by means of a Geometrical Square; which is the moſt uſeful Method of any.*

Thus, let O be a Circle, and ABCD a Square deſcribed about it, as in the Figure.——Find the Repreſentation of that Square; which will be a ſufficient Guide for drawing the Repreſentation of the Circle, to any one who has but the leaſt Notion of Drawing. But if the Circle is very large, or if this Method ſhould not be thought correct enough, then divide the Circle into any Number of Parts, and draw Lines through thoſe Diviſions parallel to the ſeveral Sides of the Square, as in the Figure; then by finding the Repreſentation of thoſe Lines, the Appearance of the Circle may be determined with great Exactneſs. Fig. 17.

METHOD 3. *To find the Repreſentation of a Circle by having only the Diameter given upon the Picture.*

Let ef be the Diameter given.——Divide ef into two equal Parts; then is n the Center of that Circle. From C, and through the Points e and f, draw Cg and Ch, at pleaſure, and make CL equal to the Diſtance CE; then through n draw Lg, cutting gC and hC in g and k; finally, from the Points g and k draw two Lines, gh, ki, parallel to the horizontal Line; and then is ghik the Repreſentation of a Square equal to the Diameter of the propoſed Circle; and conſequently, will be a ſufficient Guide for drawing its Repreſentation.

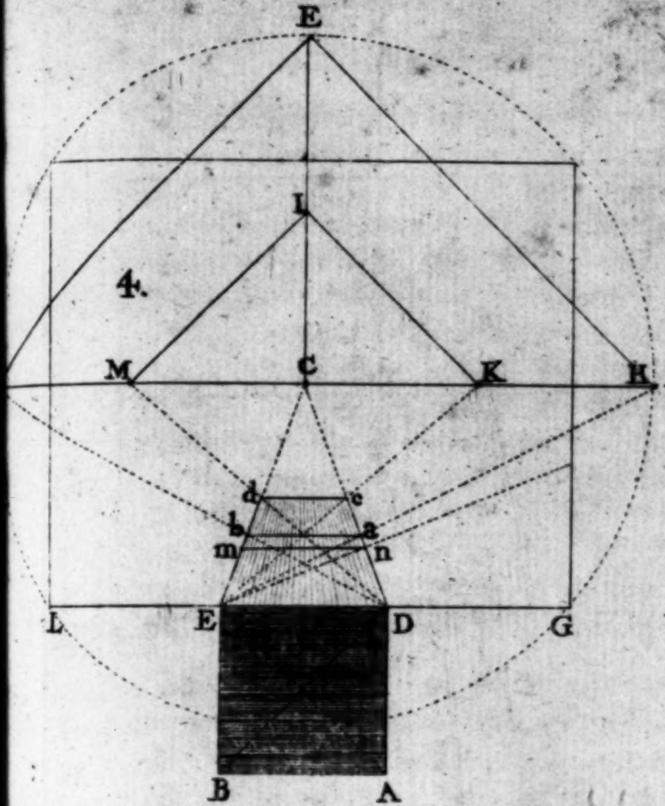
From hence then it is evident, that the Repreſentations of Circles are as eaſily to be determined upon the Picture, as any other Repreſentations whatſoever; and, that after having fixed upon the Diameter of any Circle, and the Place that Circle is to poſſeſs upon the Picture, then ſuch a Repreſentation may be determined with the greateſt Exactneſs, without the tedious Method of Plans, and that Infinity of occult Lines, which have hitherto been made uſe of.

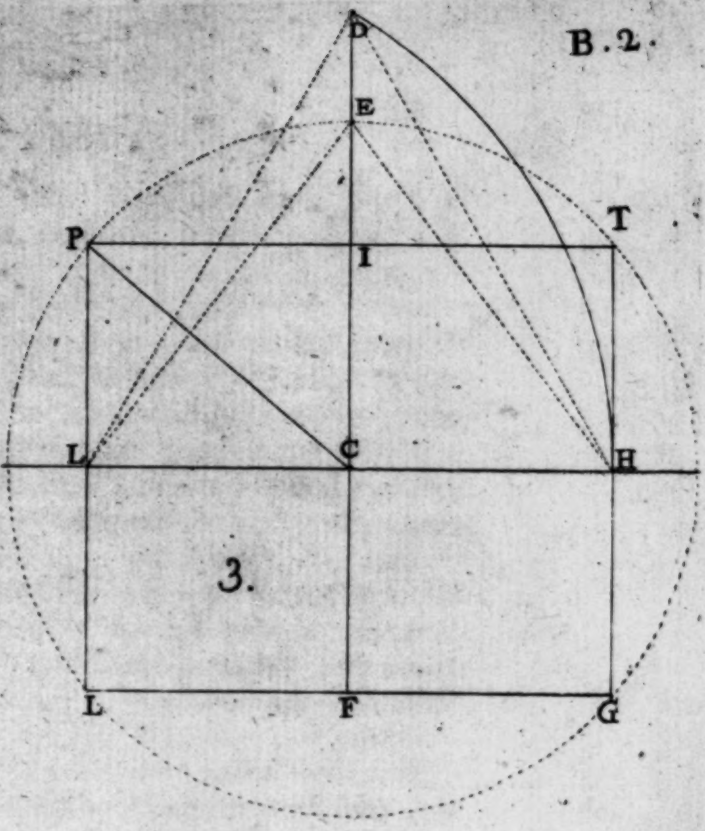
What hath been ſaid in regard to finding the Repreſentations of Circles without a Plan, or having the original Object drawn upon the Ground, is equally applicable to any of the preceding Figures, as I have ſhewn in the Courſe of this Work; and therefore, though I have put the Plans at the Bottom of each Figure, it was for no other Reaſon than to explain the Truth of the Operation; and therefore the Reader will do well to exerciſe himſelf with ſeveral Examples of the like Nature, before he proceeds to the next Section.

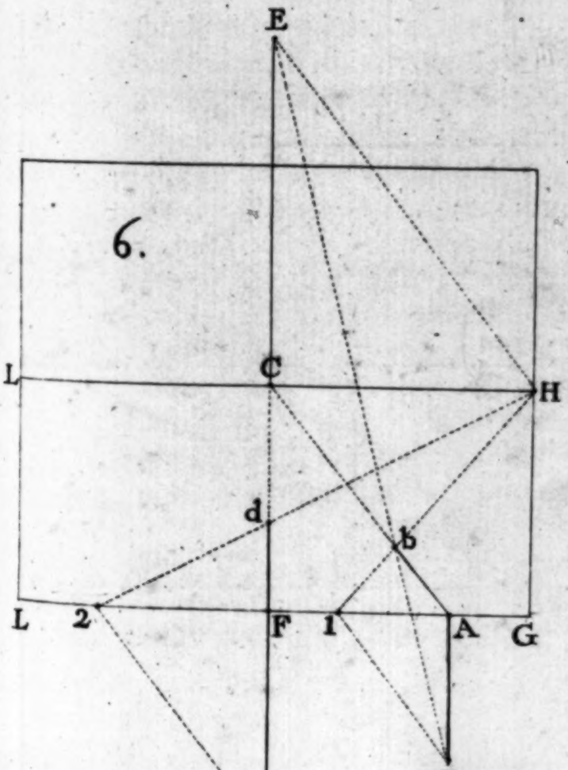
And here let us take Notice, that the Figures I have been putting into Perſpective, though few in Number, and the moſt ſimple in Nature, yet they are ſuch as comprehend Forms in general *. I ſay the Forms or Shapes of Objects in general are compounded of ſuch Figures as I have been reducing into Perſpective; that is, they muſt be either Square, Triangular, or Circular, or elſe compounded of ſome, or all of theſe put together. Thus, a Cube is compoſed of ſix Squares joined together at right Angles; a Pyramid, of ſeveral Triangles meeting in a Point; and a Column, of a Number of round Superfices laid upon each other exactly even, and perpendicular to the Ground. Theſe, and the like, may therefore be called ſimple Objects; but when they are joined together, ſo as to make but one Object, then that Object may be called a Compound one: Thus a Building may be called a compound Object; the Body of which is either a Cube or Parallelopiped; the Roof and Pediments ſeveral Triangles, and the Arches, Domes, Columns, *&c.* are nothing elſe but Circles, or Parts of Circles, put together. And therefore, it follows from hence, that whoever is able to put a Square, a Triangle, or a Circle, rightly into Perſpective, has got all the Materials that are neceſſary for drawing the Repreſentation

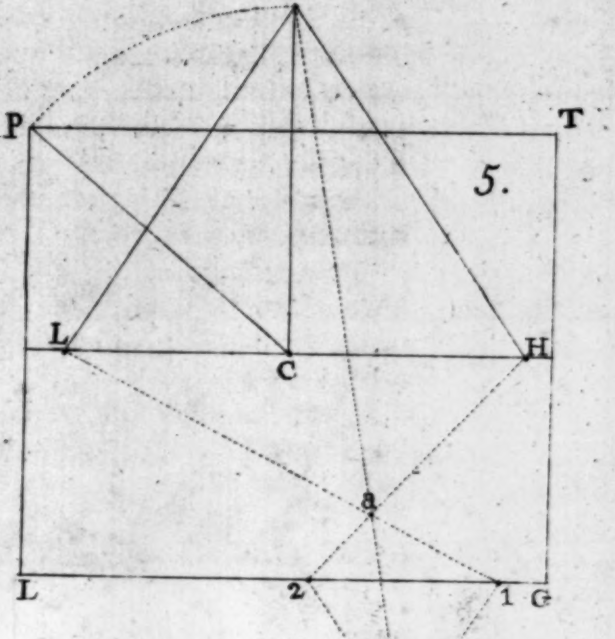
---

* I mean ſuch Forms only as are proper Subjects for Perſpective; for as to Objects which are compoſed of an infinite Variety of Curve-Lines, I will not pretend to give any Rules for determining their Appearances according to the ſtrict Rules of this Art; and was I able to do it, I ſhould think it unneceſſary; ſince a good Eye, in ſuch Caſes, will direct the Hand with more Eaſe, if not with as much Certainty, as any Rules whatſoever; eſpecially if the Perſon has a general Notion of Perſpective.

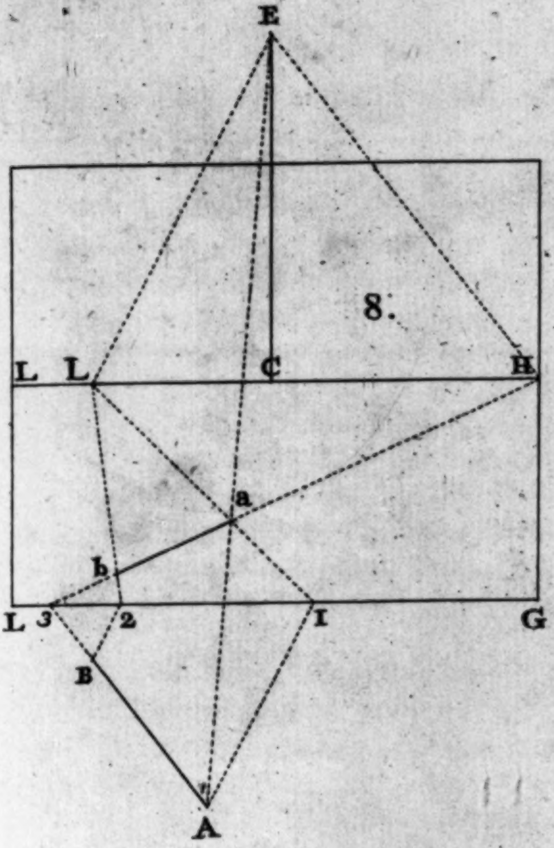

E
I
4.
M
C
K
H
d
c
b
a
m
n
L
E
D
G
B
A

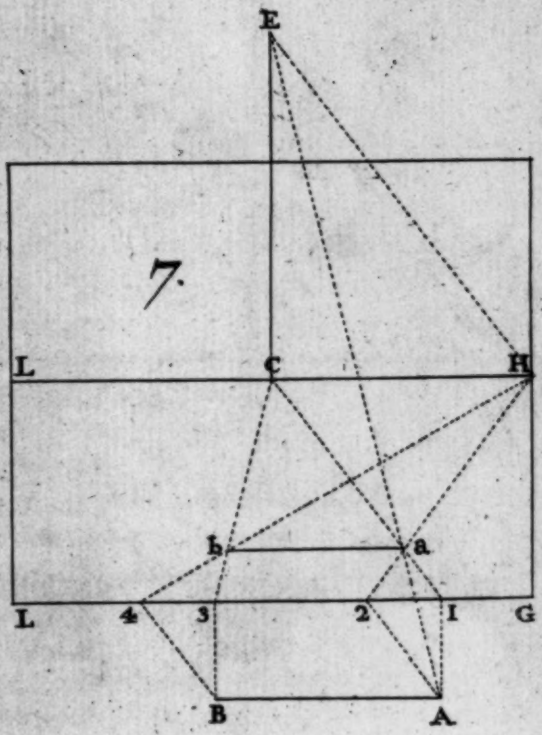

D
E
P
I
T
L
C
H
3.
L
F
G

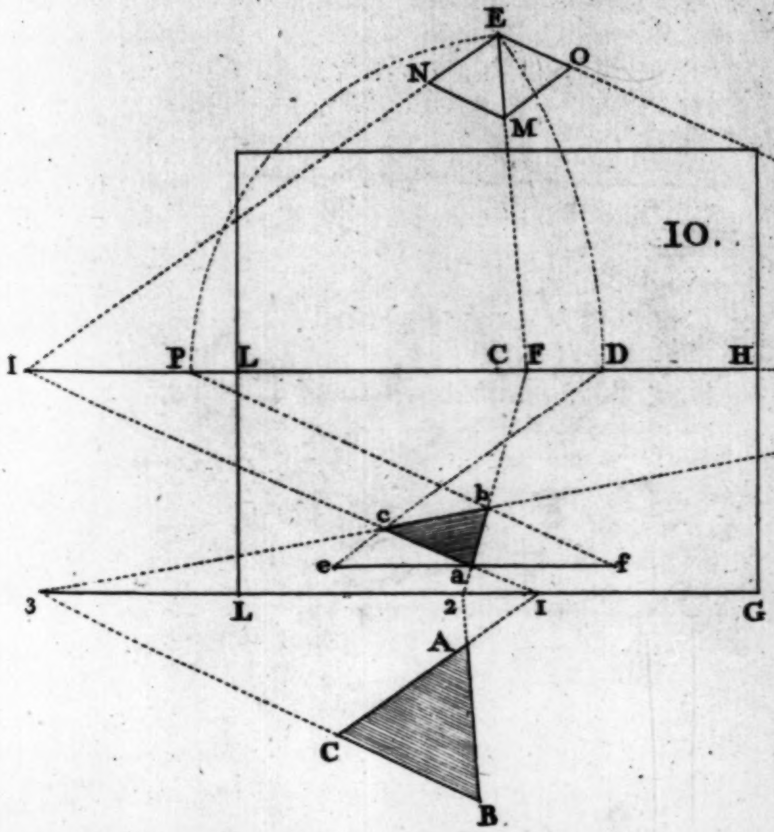

E
6.
L
C
H
d
b
L
2
F
1
A
G
B
D

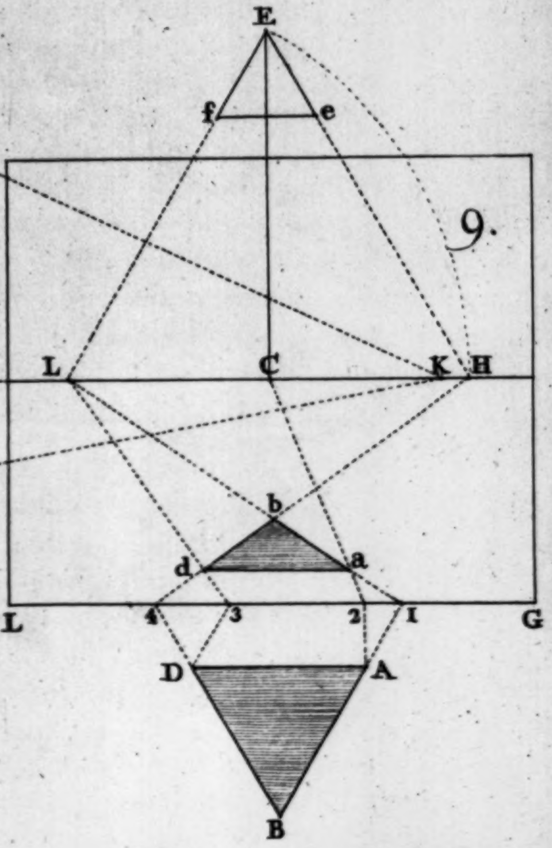

E
P
T
5.
L
C
H
a
L
2
1
G
A

BRITISH 1 JY64 MUSEUM

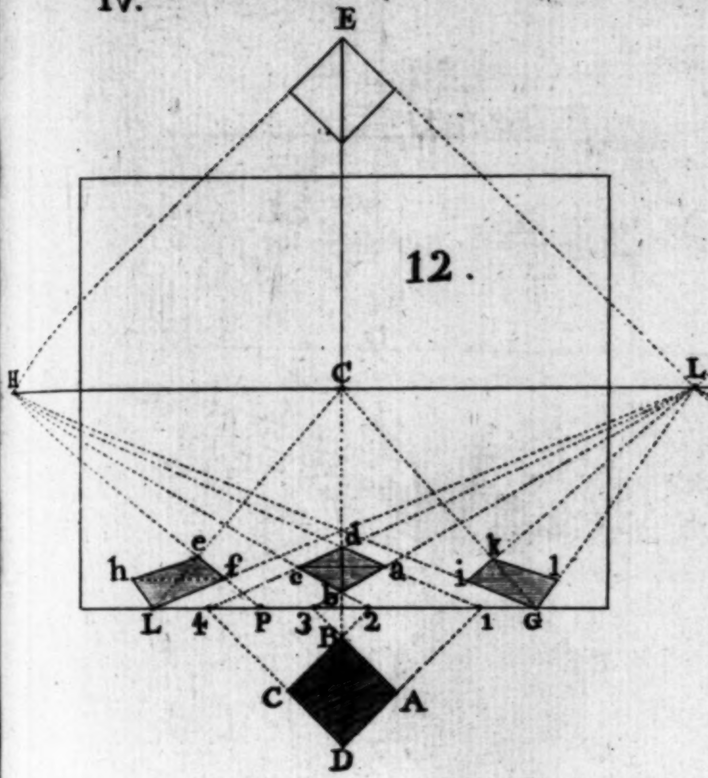

8.
E
L
L
C
H
a
b
L
3
2
I
G
B
A


7.
E
L
C
H
b
a
L
4
3
2
I
G
B
A


10.
E
N
O
M
I
P
L
C
F
D
H
b
c
e
a
f
3
L
2
I
G
A
C
B

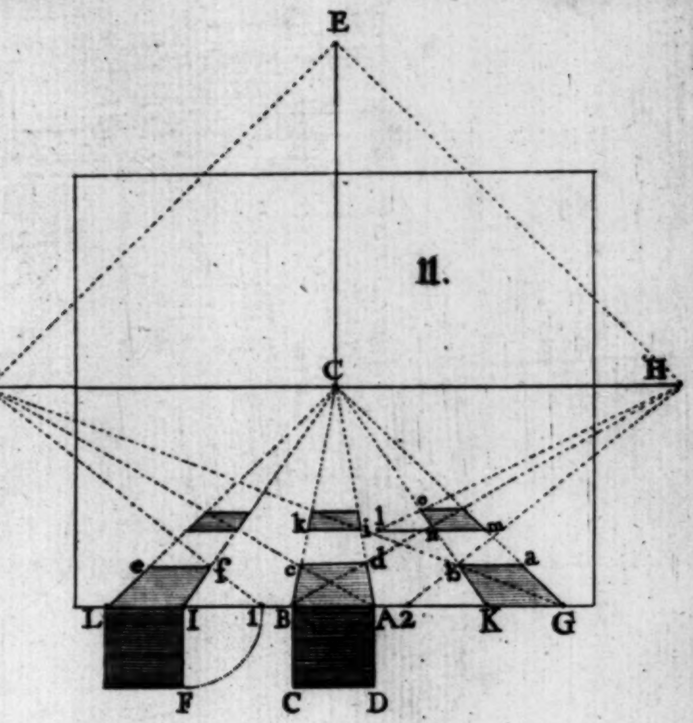

9.
E
f
e
L
C
K
H
b
d
a
L
4
3
2
I
G
D
A
B

BRITISH
1 JY64
MUSEUM



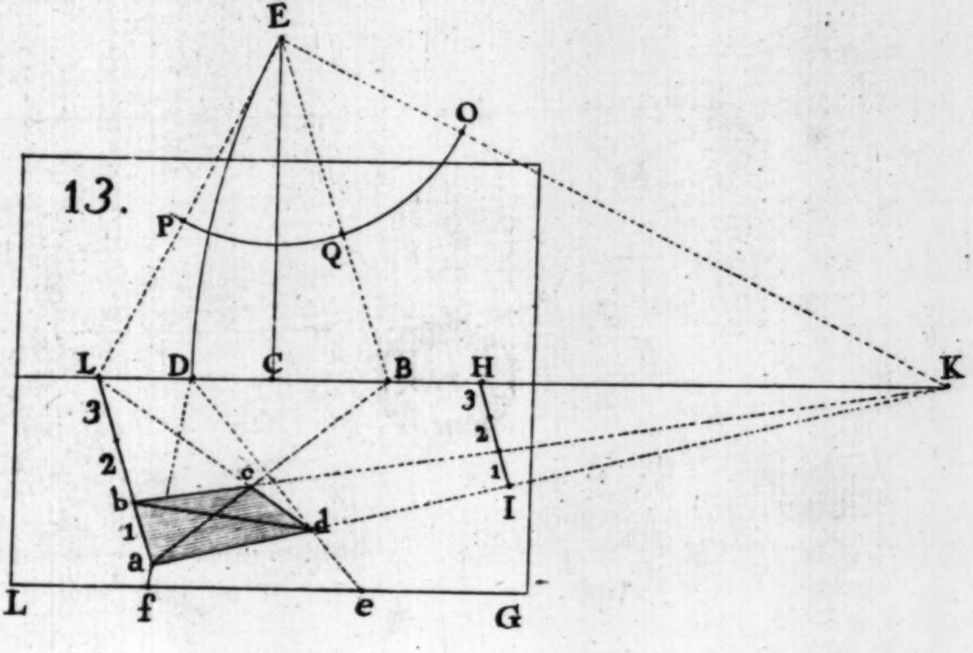
12.

E
H
C
L
d
h
e
f
c
a
i
k
l
b
L
4
P
3
B
2
1
G
C
A
D



11.

E
C
H
k
i
l
o
n
m
e
f
c
d
b
a
L
I
1
B
A
2
K
G
F
C
D

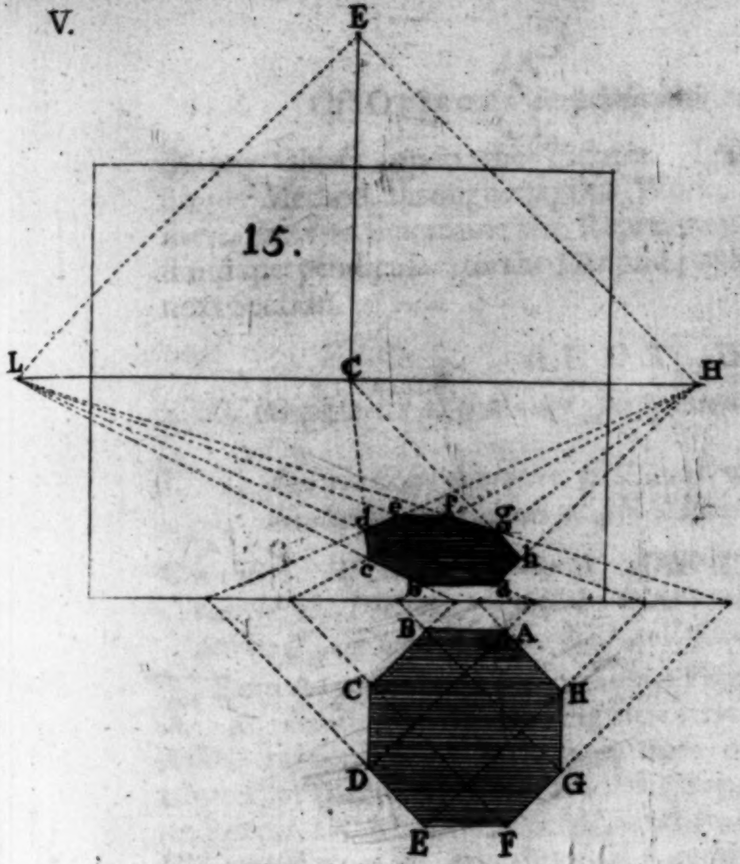


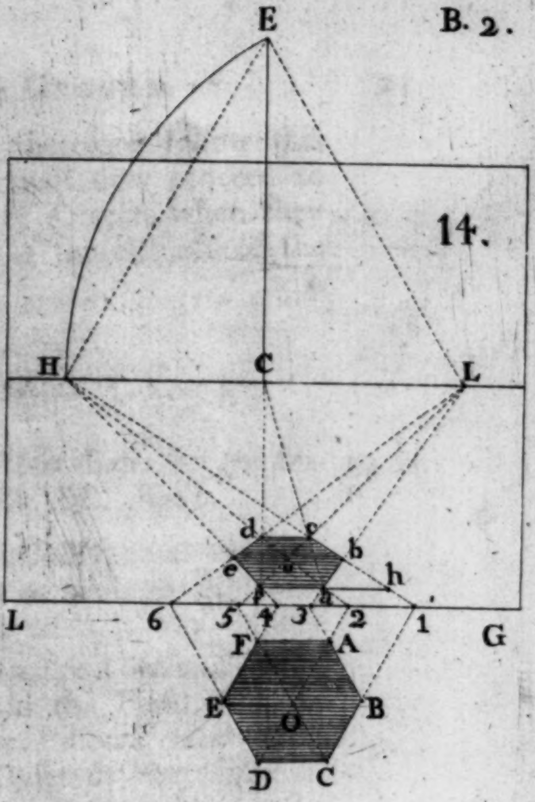
13.

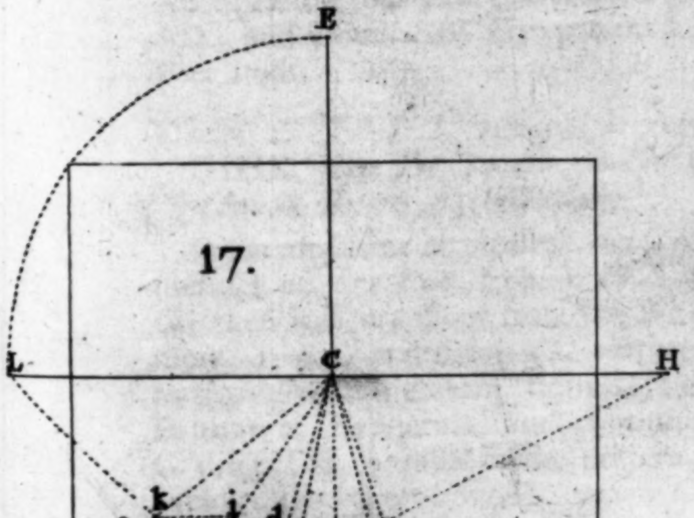
E
O
P
Q
L
D
C
B
H
K
3
2
1
b
a
c
d
3
2
1
I
L
f
e
G

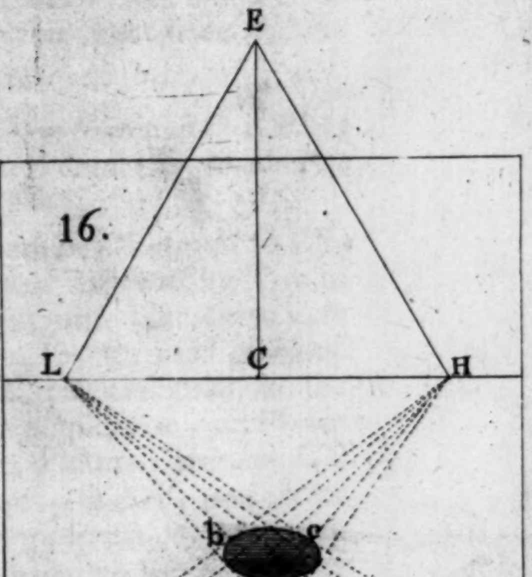
BRITISH
1 JY64
MUSEUM

V. B. 2.


15.
E
L
C
H
d e f g
c h
b a
B A
C H
D G
E F


14.
E
H
C
L
d c
e o b
f a h
L 6 5 4 3 2 1 G
F A
E O B
D C


17.
E
L
C
H
k i
f n e
h g
d c
b o a
e 8 7
B A
10 6
11 O 5
12 4
D 3 2 1 C


16.
E
C
L H
b c
a
L 4 2 3 1 G
A
B O C

BRITISH
1 JY64
MUSEUM

of any Object upon the Picture. I ſhall therefore follow this ſimple Method throughout this Work, and will now proceed to ſhew, how to determine the Repreſentation of Objects when they ſtand perpendicular to the Ground; which is the Subject of the next Section.

SECT. III.

Of OBJECTS *that are perpendicular to the* GROUND.

I. *To find the Repreſentation of Planes when their Baſes are perpendicular to the Bottom of the Picture, like* AB, *Fig.* 6. Fig. 18.

CASE 1. *When one Corner* A, *of the Plane* ABCD, *is at the Bottom of the Picture:—And let it be required to draw the Repreſentation of a Plane ſix Feet high and four Feet wide.*

FRom A, upon the Bottom of the Picture, make a Scale of Feet*, at pleaſure, as in the Figure; and from the Point A draw AD, perpendicular to the Bottom of the Picture, and continue it at pleaſure; then upon the Line AD ſet ſix Feet from A, and draw DC to the Center C, and from A draw AC; then make CH equal to CE, and draw H4 cutting AC in B; and then is AB equal to four Feet; therefore, from B draw BC, parallel to AD; and ſo will ABCD repreſent a Plane four Feet wide and ſix Feet high.

CASE 2. *Let it be required to draw the Repreſentation of a Plane* GHIK, *three Feet Square; and let the neareſt Corner* G, *be one Foot from the Bottom of the Picture.*

Draw any Line at pleaſure, as C9, and make CL equal to CE; then ſet off one Foot from 9 to 8, and draw L8 cutting C9 in G; then is G one Foot from the Bottom. Again, take three Feet more, as 85, and draw 5L cutting GC in K; then is GK equal to three Feet; therefore, draw GH and IK perpendicular to the Bottom of the Picture, and continue them at pleaſure; and from G draw GF, parallel to the Bottom of the Picture; then is GF equal to three Feet; finally, make GH equal to GF, and draw HC; which will compleat the Repreſentation propoſed.—Or it may be done thus: From 9, draw 9N perpendicular to the Bottom of the Picture, and make it equal to three Feet; then draw 9C and NC, and from 8 draw 8L, which will give the Point, or Corner, G; then draw 5L, which will give three Feet for GK; therefore, by drawing GH and IK parallel to 9N, the Thing propoſed is done.---In like Manner, ſuppoſe a Plane abcd, four Feet ſquare, was removed five Feet into the Picture, and ſuppoſe the lower Edge, or Plan, to be ſomewhere in the Line AC.---From A, where it cuts the Bottom of the Picture, ſet off five Feet for its Diſtance, (as A5) and four Feet for its Width (as 59;) then draw H5 and H9, cutting AC in a and b; then is ab the Repreſentation of its Depth; therefore, draw AD, ad, bc, perpendicular to the Bottom of the Picture, and make AO equal to four Feet; and then draw OC, cutting ad and cb, which will compleat the propoſed Repreſentation.

---

* What I here mean by a Scale of Feet, is not to make a Scale of ſo many Feet long, but only to divide the Bottom of the Picture into ſuch a Number of equal Parts, which are to be conſidered as ſo many Feet: A Thing very common amongſt Workmen.

II. *To find the Repreſentations of Planes that are parallel to the Picture.*

Fig. 19. CASE 1. *For a Plane* ABDE, *four Feet ſquare, which, we ſuppoſe, is removed two Feet from the Bottom of the Picture.*

Divide the Bottom of the Picture into any Number of Parts, which call ſo many Feet; then from G and 4, draw GC and 4C, and make CL equal to CE, and draw 6L cutting 4C in E; then is 4E equal to 4 6, that is, equal to two Feet; therefore, draw EA parallel to the Bottom of the Picture, which will cut GC in A, and give the Length of one Side, upon which make the Square ABDE, which will be the Repreſentation propoſed.

CASE 2. *For a Plane ſix Feet high and three Feet wide, which is to be five Feet from the Bottom of the Picture.*

Any where, at pleaſure, draw C4, and ſet off three Feet, (as 4 7) then draw 7C, and from 4 ſet off five Feet, (as 4 9) and draw 9L, which will cut 4C in e; then will e4 be equal to 4 9, that is, to five Feet. Again, from e, draw ef parallel to the horizontal Line, which will give ef equal to three Feet; that is, equal to 4 7; therefore, continue ef at pleaſure, and call a, one Corner of the intended Plane; make ab equal to ef, and draw ad, bc, perpendicular thereto; then make ad equal to twice ab, and draw dc parallel to the horizontal Line, and then will the Repreſentation be compleated.

III. *To find the Repreſentation of Planes, when their Plans or Baſes are oblique with the Bottom of the Picture, like* AB Fig. 8.

Fig. 20. Let ABDF be the Repreſentation ſought, which let be ſix Feet high, four Feet and a Half wide, and one Foot and a Half from the Bottom of the Picture; and let L be its vaniſhing Point, and LG the Line in which the Plane is to ſtand.——Draw GI perpendicular to the Bottom of the Picture, and ſet ſix Feet upon it (as in the Figure) and draw IL; then from G ſet off Ga equal to one Foot and a Half, and draw aH cutting GL in A; then is GA equal to Ga; that is, equal to one Foot and a Half. Again, from a, ſet off four Feet and a Half, (as a 6) and draw 6H cutting GL in B; then is AB equal to a6, that is, equal to four Feet and a Half; therefore by drawing AF and BD perpendicular to the Bottom of the Picture, we ſhall have the Repreſentation of a Plane, ſix Feet high, and four Feet and a Half wide.

Fig. 21. If the vaniſhing Point L is out of the Picture, the Figure may be drawn thus.——Let BA be the Repreſentation of one Side given, and AD its Height.——Continue AB at pleaſure, and any where upon it draw ab perpendicular to the Bottom of the Picture; then make cb to ca, as FD is to FA, and draw Db; which will give the Length of BC; for if DC be continued it will vaniſh into L*.

From hence then it is evident, that the Repreſentation of any perpendicular Plane may be immediately determined upon the Picture, without having Recourſe to the tedious Methods of Plans, Elevations, &c. and but very few Lines are required, even when the Repreſentation is to be of any given Dimenſions, or however it is to be ſituated upon the Picture: But, if the Repreſentation is not to be of any particular Dimenſion, being left to the Diſcretion of the Artiſt, then nothing can be more ſimple than the Operation. For Fig. 18. let AB be one Side given, and AD its Height; then from A and B draw AD, BC, perpendicular to the Bottom of the Picture; and from C, draw CL; which will compleat the Figure.

Here let us obſerve again, that the vaniſhing Point C of the Line AB, is the vaniſhing Point of every Line DC, NM, &c. that is parallel to AB; agreeable to the ſecond Axiom.

Having ſhewn how to find the Repreſentation of Square Planes perpendicular to the Ground; let us now proceed to join them together, which begins the Perſpective of ſolid Figures.

---

* Suppoſe FD is equal to FA, then cb muſt be made equal to ca.

IV. *To*

IV. *To find the Repreſentation of Triangular Pieces of Wood, &c. when they are either above or below the Horizontal Line.*

Fig. 22. CASE 1. *When they are below the Horizontal Line, and have one Side,* abcd, *parallel to the Picture.*

Find the vaniſhing Points H and L, of the oblique Sides, as taught in Figure 9; then from b and d, draw bL, dH, cutting each other in c; then is bcd the Top; which compleats the Figure. In this Figure the Front Side abde, is parallel to the Picture, but in the Figure nopqrm, the back Side npmq is parallel to the Picture; therefore let us find the Appearance of that alſo:—Here let mqpn be the parallel Side given.—Through the Points n and m draw Lines from H, and through the Points p and q draw Lines from L, which will cut the Lines Hm, Hn, continued in o and r; therefore draw or, and the Thing propoſed is done.—Or it may be found by giving one Edge mr.—Continue mr to its vaniſhing Point H, and draw rL; then draw mq parallel to the horizontal Line, cutting rL in q; then is rq the other Side; therefore draw mn, ro, pq, each perpendicular to the horizontal Line, and make any of them the propoſed Height, (ſuppoſe ro) then draw oH, oL, cutting mn, and qp, in n and p, and then draw np; which finiſhes the Figure.

CASE 2. *When they are above the Horizontal Line.*

Let fg be one of the Bottom Edges given.—Draw fi perpendicular to [illegible] horizontal Line, and make it equal to the propoſed Height; from f draw fL, then draw gl parallel to the horizontal Line, cutting fi in l; and then is fl the Depth of the other Side; therefore draw gh and lk parallel to fi, and from i draw iH and iL; which compleats the Repreſentation.

V. *To find the Repreſentation of any triangular Figure, when all its Sides are oblique with the Picture.*

Fig. 23. CASE 1. *When it is below the Horizontal Line.*

Let AD be one Edge given, whoſe vaniſhing Point is out of the Picture; and let L be the vaniſhing Point of the other Edge AG.—Make AG equal to AD, by Figure 10; and from A, D, G, draw Lines perpendicular to the Ground; then make AB equal to the Height, and draw BL; which will compleat the Side ABFG: Again, continue AB and DE to the horizontal Line, and make

DE to DH, as AB is to AR[*]; then draw BE, which compleats the Side ABED; finally, draw EF, which finiſhes the Repreſentation. For, if AD and BE were continued, they would both vaniſh into the ſame Point in the horizontal Line; as was obſerved in Figure 21.

CASE 2. *When it is above the Horizontal Line.*

Let HO be one Edge given, whoſe vaniſhing Point is out of the Picture, and let L be the vaniſhing Point of the Edge HN.—Make HN equal to HO, as before; and from N, H, O, draw Lines perpendicular to the Ground; then make HK equal to the propoſed Height, and draw KL, which will give one Side: Again, make PQ (the Part above the horizontal Line) to PO (the Part below the horizontal Line) as IK is to IH (which in this Figure is as 2 is to 3) and draw KQ; which will compleat the Repreſentation propoſed. For if HO and KQ were continued, they would meet in a Point upon the horizontal Line.

This Method of determining the Appearance of any Line, when its vaniſhing Point is out of the Picture, is extremely uſeful; and therefore, the Reader cannot make it too familiar to him; the general Method for which I have farther explained in Figure 41.

VI. *To find the Repreſentations of Cubes, both above and below the Horizontal Line, when ſome of their Sides are parallel to the Picture.*

CASE 1. *When below the Horizontal Line.*

Let abeg be one Side given.—Draw bC, [illegible]C, and [illegible]C, and find the vaniſhing Point H of the Diagonal e[illegible] by Figure 11; and draw eH cutting Cg in f; then from f, draw fd parallel to the horizontal Line, cutting eC in d; and then draw dc parallel to eb, and the Repreſentation is compleated. And for the Cube E—Make the front-ſide like the Cube A, and draw Lines from the upper Corners to the Center C; then by continuing eg and fd, we may compleat the other alſo; as in the Figure. And therefore, having got one Repreſentation, That will be ſufficient for any Number of the ſame Kind, provided they ſtand all in the ſame Line, and; that is, at the ſame Diſtance from the Bottom of the Picture.

Fig. 24.

---

[*] Suppoſe AB is four Parts, and BR one Part; then divide DH into five Parts; and then is HE to ED as RB to BA; that is, as one to four.

CASE 2. *When above the Horizontal Line, as* B *and* D.

Here let the Reader obſerve, that the Rule in either Caſe is the ſame; and therefore he is to proceed in the ſame Manner in finding the Repreſentation of a Cube above the Eye, as we have done in determining the Appearance of a Cube below the Eye; which is ſufficiently explained by the Figures.——And ſo likewiſe for the Depth m o, of the Parallelopiped F; which is found by drawing a Line from the Corner n, to the vaniſhing Point of the Diagonal H.

VII. *Of a Cube and Parallelopiped, whoſe Sides are all oblique with the Picture.*

CASE 1. *Of the Cube.*

Fig. 25. Let a b be given, whoſe vaniſhing Point is L; and let H be the vaniſhing Point of the other Side ag.—From a, draw a 1 parallel to the horizontal Line, and make L A equal to the Diſtance LE; then through b, draw A 1, cutting a 1 in 1; and then is a 1 equal to ab; and from a and b draw Lines perpendicular to the horizontal Line, and make a e equal to a 1; then from e, draw eL, cutting bc in c; and then we ſhall have one Side: Again, from c and e, draw Lines to H, and from e, draw a Line to C, (the vaniſhing Point of the Diagonal) which will cut cH in d; then from L draw a Line through d, cutting eH in f; finally, from f, draw f g parallel to a e; and then will the Repreſentation be compleated.

CASE 2. *Of a Parallelopiped, or oblong Piece of Wood, reſting upon one of its longeſt Faces.*

Let it be required to make it three Feet long, one Foot thick, and one Foot high: And let o be the neareſt Corner, and HL the vaniſhing Points of the Sides.——Through o, draw 2 o 3, parallel to the horizontal Line, and ſet off three Feet upon it; then draw oH and oL, and make HB equal to HE, and draw B 2 cutting oH in i; then is o i equal to three Feet: Again, make LA equal to LE, and from o, ſet off o 3, equal to one Foot; then draw 3A, cutting oL in n; and then is o n equal to o 3: Again, from i, o, n, draw Lines perpendicular to the horizontal Line, and make o m equal to o 3; finally, from m, draw mH and mL, cutting i h in h, and n l in l; then from l draw a Line to H, and from h draw a Line to L, which will cut each other in k, and ſo finiſh the Repreſentation; which will be three Feet long, one Foot thick, and one Foot high.

VIII. *To find the Repreſentation of an Hexangular Figure, both above and below the Eye.*

Case 1. *When below the Eye.*

Fig. 26. Let ab be one Side given, and let H and L be the vaniſhing Points of the other Sides.—Continue ab on either Side, at pleaſure, and make a 1, b 2, equal to ab; then cut off ae and bf, equal to 1 a and 2 b; and from e, a, b, f, draw Perpendiculars to ab; then make ad equal to the propoſed Height, and draw cd parallel to ab; then from c and d, draw Lines to L and H, cutting fh and eg in h and g; and from g and h, draw Lines to L and H, and from c and d, draw Lines to C, cutting them in i and k; finally, draw ik, which will be parallel to cd, and will be the Repreſentation propoſed.

Case 2. *When above the Eye.*

Let mn be one Side given, and H, L, the vaniſhing Points of the other Sides, as before.—Continue mn, at pleaſure, as 34, from whence the other Sides may be found, and conſequently, the whole Repreſentation; as is evident by the Figure: In which I have put every Line in the Operation, to make it eaſy to be underſtood without any further Explanation.

From hence then it follows, that the Appearance of any Objects may be as eaſily determined above the horizontal Line as below it; ſince one Rule ſerves in both Caſes; and therefore it matters not whether we begin our Work at the Bottom or at the Top of the Picture. Now, this Method of finding the Repreſentation of Objects is of prodigious Uſe. For ſuppoſe it was required to draw the Repreſentation of the Top of any Building; we need not ſketch out any more of it than is to appear upon the Picture; but we may begin in the very Place where that Top is to be, without undergoing the tedious Taſk of beginning at the Bottom of ſuch a Building, and afterwards rubbing out what is not to appear.

IX. *To put an Octangular Building into Perſpective.*

Fig. 27. Let ab be one Side given, and let H, C, L, be the vaniſhing Points of the ſeveral Sides.—Find the Repreſentations of the Sides, as ak, bc, and cd, which are viſible to the Eye (by Fig. 15.) and from the ſeveral Points h, a, b, c, d, draw Perpendiculars to the Bottom of the Picture; then make ak equal to the propoſed Height, and draw kg parallel to ab, which compleats one Side; then from k

draw k H, and from g draw g L, which finiſhes two Sides more; finally, from f draw f C, which will compleat the whole Repreſentation.

X. *To find the Repreſentation of Cylindrical, or round Objects, ſuch as Columns, and the like.*

In the 16th and 17th Figures we have ſhewn ſeveral Methods of finding the Appearance of Circles upon the Picture, by which means the Repreſentations of Circles of any Dimenſions may be determined with great Exactneſs; and ſince a Circle is the Baſe of a cylindrical Object, therefore, by finding the Repreſentation of two Circles at any determinate Diſtance, the Appearance of that Object may be determined alſo.

Fig. 28. *Let it be required to find the Repreſentation of a round Object like* D.

CASE 1. *When it ſtands upon one End.*

Let e f be the Diameter given, and n the Center of the Circle. ----Draw n b perpendicular to the Bottom of the Picture, and make it equal to the Height you intend for the Repreſentation; then, by Method 3, Fig. 17, find the Repreſentation of the Square g h f k i e; which will be a ſufficient Guide for drawing the Appearance of the Circle, as in the Figure. Again, through b, draw c d parallel to e f, and, by the ſame Method, find the Repreſentation of the Square a l, which will be a Guide for the upper Circle; finally, from the Extremities of both Circles, draw e c, f d, parallel to n b, which will exhibit the viſible Appearance of the round Object, as in Figure D.

From hence then it is manifeſt, that any Number of round Objects, (ſuch as Columns, *&c.*) may be found upon the Picture, by having only their Diameters and perpendicular Heights, as we have further ſhown in Figure 63, *&c.*

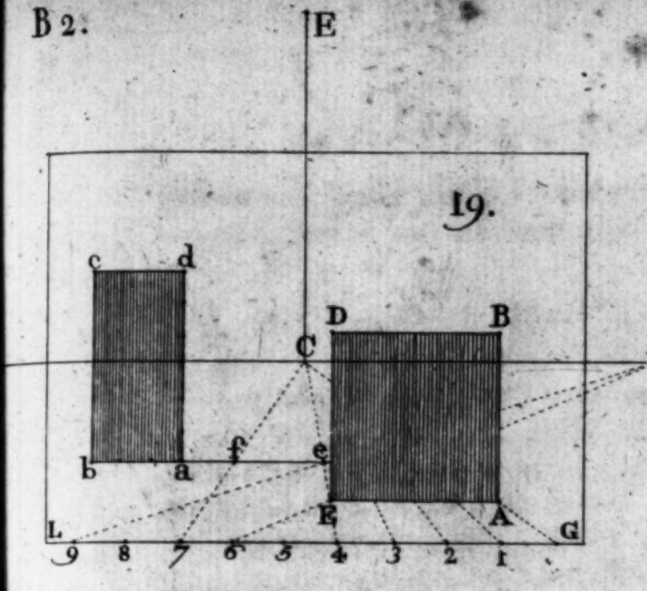
Fig. 29. CASE 2. *When a Cylinder lies upon the Ground oblique with the Picture.*

This alſo may be done with the greateſt Eaſe, by finding the Appearance of two geometrical Squares. Thus, let A be the Corner of the Square for the neareſt End of the Cylinder, AB its Diameter, and AC its given Length; and let H be the vaniſhing Point of the End, and L the vaniſhing Point of the Sides.----Cut off AE equal to AB, and from the Points AE draw Perpendiculars, and compleat the Square a; then draw its Diagonals, *&c.* and

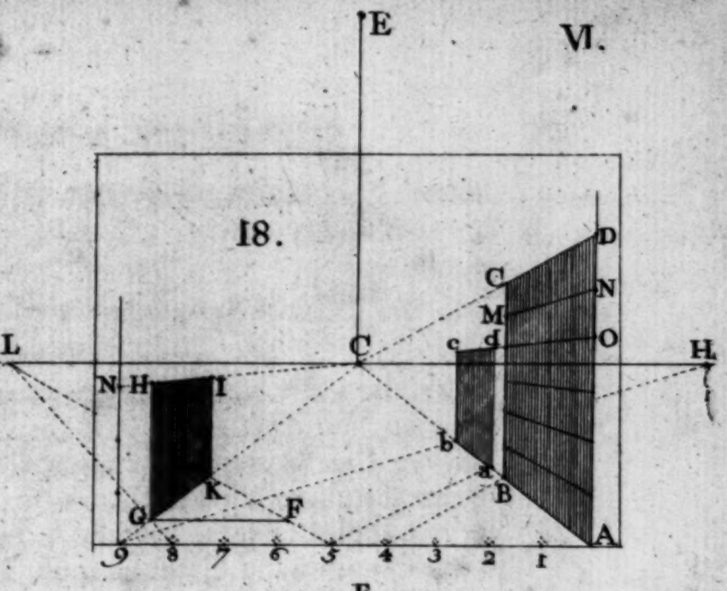
B 2.

VI.

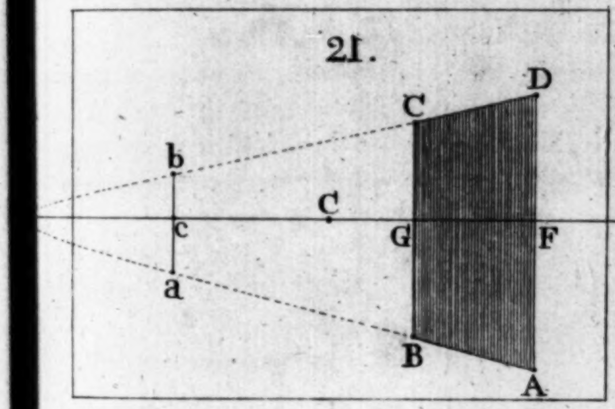
19.



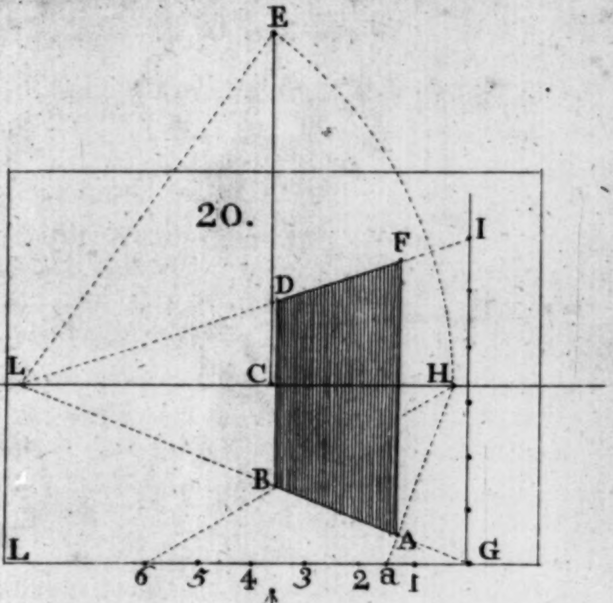
18.



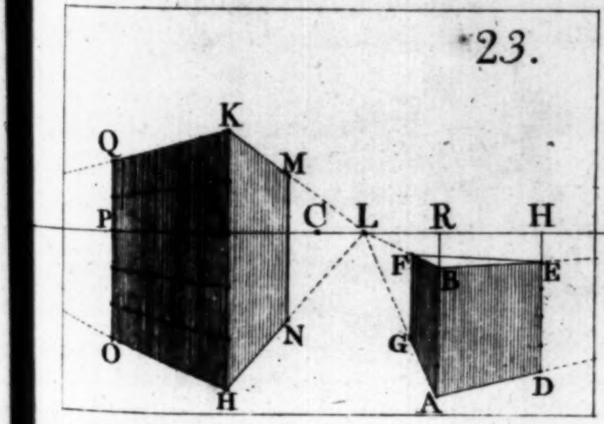
21.



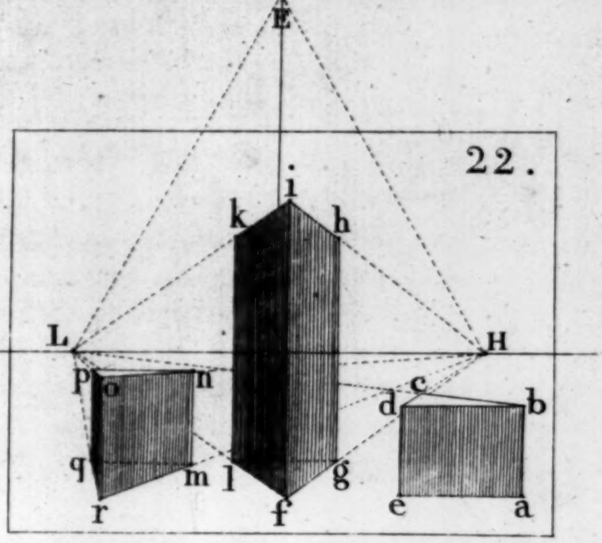
20.



23.

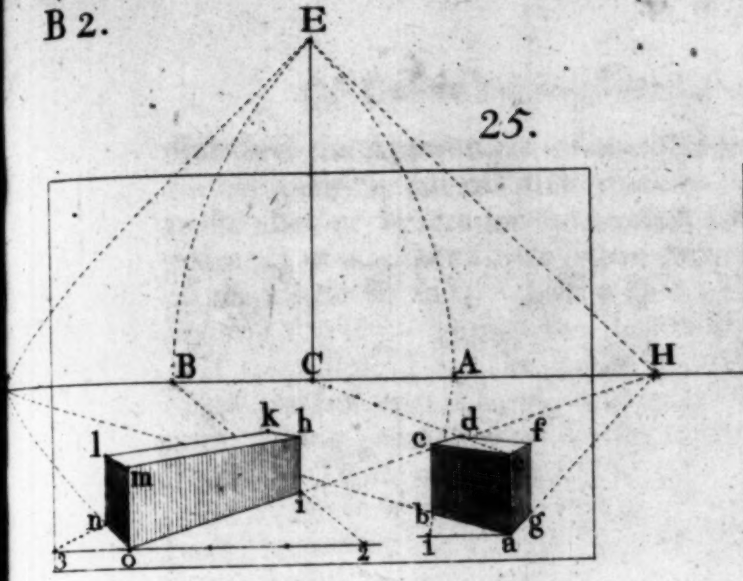


22.

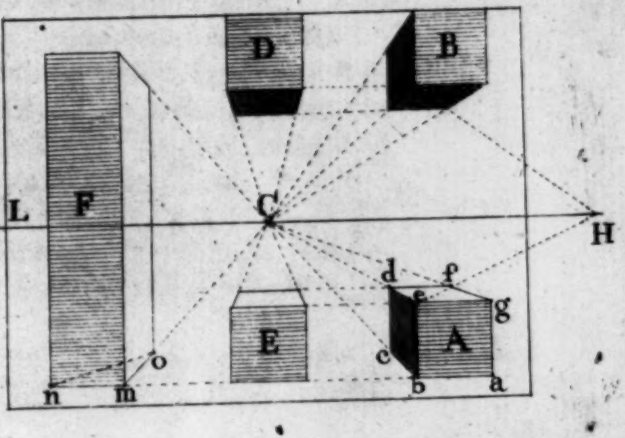


BRITISH
1 JY64
MUSEUM

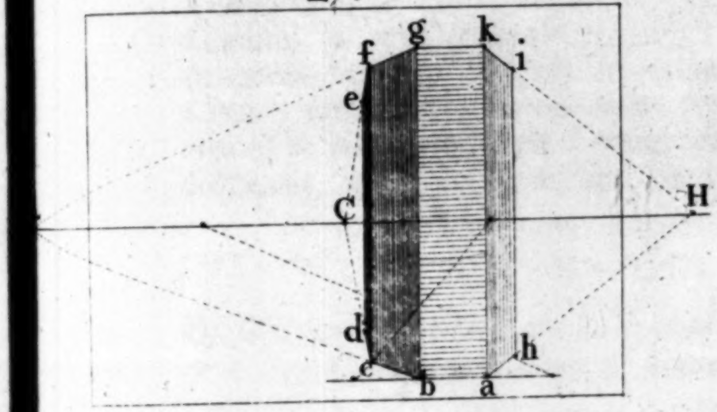
25.



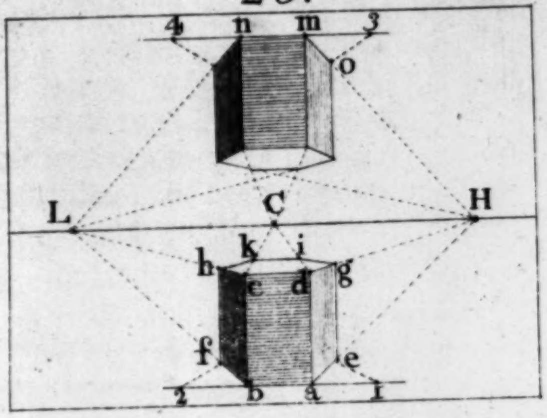
24.



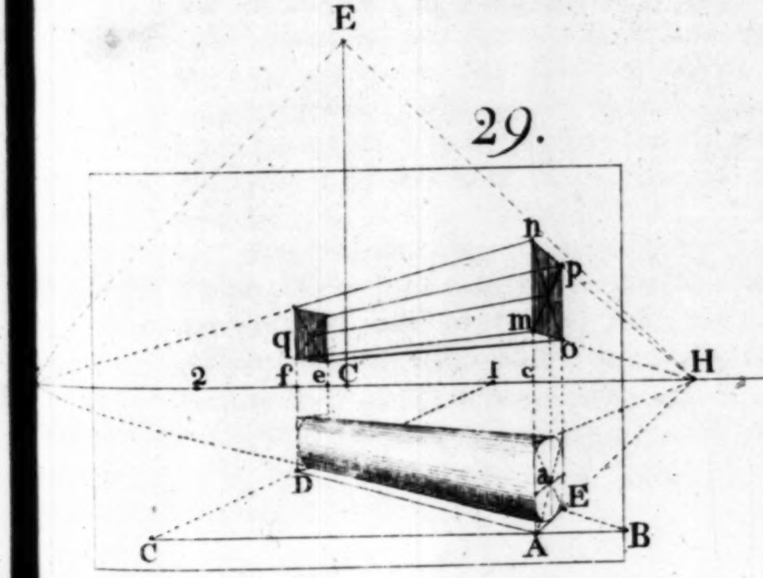
27.



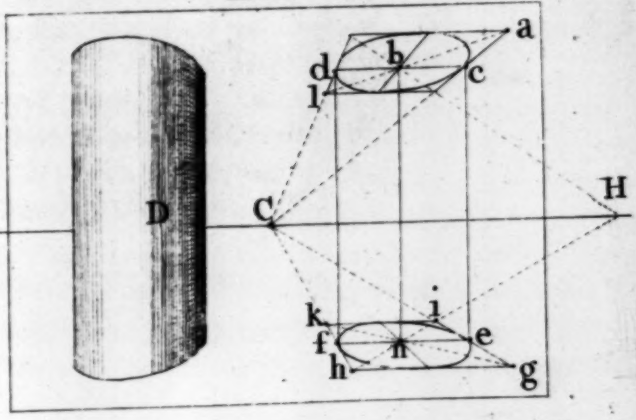
26.



29.



28.



BRITISH
1 JY64
MUSEUM

and then the Appearance of the Circle, as in the Figure. And for the Length, cut off AD equal to AC, and from the Point D, make another Square for the fartheſt End, in which draw the Appearance of another Circle; then draw Lines from the Extremities of the Circle a, to L, which will cut the Circle in the Square at D, and thereby compleat the Repreſentation as required.

If there ſhould not be Room enough for the whole Draught below the horizontal Line, it may be done above it, as in the Figure, taking great Care to make them both at the ſame Diſtance from it.—Thus, cn is equal to cA.

From hence it appears, that this Figure is determined after the ſame Manner as the oblong Piece of Wood, Fig. 25; only, one is ſquare and the other circular.

Theſe Examples are ſufficient to ſhew the whole Practice of Perſpective, ſo far as it relates to Objects which lie flat upon the Ground, or are perpendicular to it: For, as I obſerved before, the immediate Objects of Perſpective, are a Triangle, a Square, and a Circle; and therefore were we to multiply Objects to infinity, they would be compounded of ſome or all theſe put together; and conſequently, what has been ſaid already, is ſufficient for our Purpoſe.

SECT. IV.

Of OBJECTS *which are inclined to the* GROUND, *ſuch as Pediments, Roofs of Houſes, and the like.*

THIS Part of Perſpective, neither the *Jeſuit*, nor *Pozzo*, nor many others, ſeem to have had the leaſt Knowledge of; for they have confined themſelves wholly to the horizontal Line, without conſidering any other vaniſhing Line; and therefore, when they have ſhewn how to find the Appearances of inclined Objects, they did it by means of Plans, Elevations, *&c.* which is not only a tedious, but an uncertain Method. But, Dr. TAYLOR has ſhewn us, that inclined Objects have their proper vaniſhing Lines and Points, as well as thoſe Objects which lie flat upon the Ground, or are perpendicular to it; and that the Method for determining the Appearance of Objects in either Caſe, is exactly the ſame. Which we are now going to demonſtrate.

Fig. 30. I. *To find the Repreſentation of a Square, by means of its Diagonals only, when it is ſituated like* GHIK, *Fig.* 18.

Method 1. *Let* ab *be the lower Edge.*

Continue ab to its vaniſhing Point C, and through C, draw EV perpendicular to HL, which will be the vaniſhing Line of the propoſed Plane; then make Cℭ equal to the Diſtance of the Eye; and draw AB parallel to the horizontal Line; upon which make the Square ABCD of any convenient Bigneſs, and draw its Diagonals AC, BD; then from ℭ, draw ℭE and ℭV parallel to the Diagonals AC, BD; and where they cut the vaniſhing Line EV, will be the vaniſhing Points ſought: Thus, E is the vaniſhing Point of the Diagonal ac, and V is the vaniſhing Point of the Diagonal bd.

Method 2. *By making a given Angle at the Eye.*

The Angle of a Square is a right Angle, and contains 90 Degrees, the half of which is 45 Degrees; therefore, at ℭ, with the horizontal Line, make two Angles, CℭE and CℭV, each equal to 45 Degrees, then draw ℭE, ℭV, cutting the vaniſhing Line in E and V; which will be the vaniſhing Points, as before.

Method 3. *By the Diſtance of the Eye only.*

Through the vaniſhing Point C, draw the vaniſhing Line EV, and make CE, CV, each equal to the Diſtance CE of the Eye, which gives the vaniſhing Points propoſed.

From hence then it appears, that Planes which are perpendicular to the Picture, and to the Ground alſo, will have their vaniſhing Lines paſs through the Center of the Picture, perpendicular to the horizontal Line; and that all the oblique Lines which can be drawn within thoſe Squares, will vaniſh into this Line, for the ſame Reaſon that all the oblique Lines which can be drawn within a Square that lies upon the Ground, will vaniſh into the horizontal Line. And from hence alſo we may conceive, why Roofs, Pediments, &c. will have their proper vaniſhing Points as well as any other Objects. For let abe be the End of a Roof or Pediment, then is E the vaniſhing Point of the Side ae which is next the Eye, and V is the vaniſhing Point of the other Side be; and if Lines are drawn through E and V, parallel to the horizontal Line, then theſe Lines will be the vaniſhing Lines of the Sides of the Roof, for the ſame Reaſon that EV is the vaniſhing Line of its Ends: As is evident from the next Figure.

II. To

Fig. 31.

II. *To find the vaniſhing Lines and vaniſhing Points of a Roof, when the End of the Building is ſituated like* a b c d *in the laſt Figure.*

Draw the vaniſhing Line I J, as before taught, and make Cℭ equal to the Diſtance of the Picture.----Parallel to the horizontal Line, (or if you pleaſe upon the horizontal Line) draw AB, upon which, draw the End of the Roof, as ABC; then from ℭ, draw ℭV, ℭL, parallel to A B, B C, cutting the vaniſhing Line in V and L; then are V and L the vaniſhing Points of the inclined Edges a c, b c. Again, through V and L draw 𝔙𝔏 and v l parallel to the horizontal Line, and then will 𝔙𝔏 be the vaniſhing Line of the inclined Side a e c d, and v l will be the vaniſhing Line of the inclined Side b c d.

Now in order to find any vaniſhing Point upon either of the vaniſhing Lines 𝔙𝔏, or v l, we muſt proceed exactly in the ſame manner as in finding any vaniſhing Point upon the horizontal Line; namely, by ſetting off the Diſtance of the vaniſhing Line, and then drawing Lines from thence parallel to any original Lines whoſe vaniſhing Points are required. Thus, let it be required to find the vaniſhing Points of the Diagonals of a Square, whoſe Sides vaniſh into the Center V, of the vaniſhing Line 𝔙𝔏; like a g, b c, Figure 32.---Make V I equal to Vℭ, and L J equal to Lℭ; then at I and J, with the Lines V I, L J, make Angles of 45 Degrees each, as in the Figure, and draw the Lines I𝔙, I𝔏, J v and J l; which will give the vaniſhing Points propoſed.---Or it may be done by making 𝔙V, 𝔏V, *&c.* equal to the Diſtance Vℭ, which comes to the ſame Thing. For ſuppoſe the Picture removed into the Place of the 32d Figure; where 𝔙𝔏 is the vaniſhing Line of the Square a b f g, and 𝔙 and 𝔏 the vaniſhing Points of its Diagonals; and let a b be one Edge of the Square, which ſtands upon the Ground.---From a and b draw Lines to V, which is the vaniſhing Point of the Sides a e, b d; and then from b draw a Line to 𝔙, and from a, draw a Line to 𝔏, cutting a V and b V in f and g; finally, draw g f; and then will a b f g be the Repreſentation of a Square inclined to the Ground, like the Line A C, Fig. 31. And in like Manner, if another Square was required, as f g e d, it may be found by repeating the laſt Operation; that is, by means of the Diagonals, as is evident by inſpecting the Figure: Or any Number of Squares may be found by the ſame Method. From whence it is manifeſt, that the Repreſentation of any inclined Object may very eaſily be determined, and made of any given Proportion.

Fig. 32.

And what has been ſaid about the inclined Side abed, is equally applicable to the oppoſite inclined Side; ſince the only Difference conſiſts in working below the horizontal Line, inſtead of above it: For vl is its vaniſhing Line, and v and l the vaniſhing Points of the Diagonals, *&c.*—I have added the Figure A, which repreſents, as it were, the Frame-work of the other; and will ſerve to explain the Thing more fully.

The principal Difficulty in determining the Repreſentation of any inclined Planes, lies in finding the Center and Diſtance of their peculiar vaniſhing Lines; therefore, before we proceed any further, we will give ſome general Rules for that Purpoſe, as is moreover explained by the 50th Figure.

1. *To find the Center of a vaniſhing Line.*

Fig. 34. Let 𝔙L be a vaniſhing Line given.---From C the Center of the Picture, draw CH perpendicular to the vaniſhing Line 𝔙L, and then is H the Center of that vaniſhing Line. Again, let 𝔙𝔏 be a vaniſhing Line given.----From C the Center of the Picture, draw CO perpendicular to 𝔙𝔏, and then is O the Center of that vaniſhing Line.

2. *To find the Diſtance of a vaniſhing Line.*

Continue the Perpendiculars CH, at pleaſure, towards 𝔈; and from the Center of the vaniſhing Line draw HE to the Eye; then is HE the Diſtance of the vaniſhing Line 𝔙L; therefore, ſet off H𝔈 equal to the Diſtance HE, and then is 𝔈 the Diſtance to be work'd with. Again, for the vaniſhing Line 𝔙𝔏—Continue the Perpendicular CO towards I, at pleaſure, and from O ſet off OJ upon the vaniſhing Line, equal to CE, the real Diſtance of the Eye, and draw CJ; then is CJ the Diſtance of the vaniſhing Line 𝔙𝔏; and by making OI equal to CJ, we ſhall have I for the Point of Diſtance of the vaniſhing Line 𝔙𝔏. From hence then it will appear, that C is the Center of the horizontal Line in the 30th Figure, and it is alſo the Center of the vaniſhing Line EV; that CE is the Diſtance of the Picture, (that is, of the horizontal Line) and C𝔈 is the Diſtance of the vaniſhing Line EV: And becauſe the vaniſhing Line EV paſſes through the Center of the Picture, therefore the Diſtances CE and C𝔈 muſt be equal. Again, V and L, of the 31ſt Figure, are the Centers of the vaniſhing Lines 𝔙𝔏 and vl; and VI, LJ, are their Diſtances, and ſo on. Thus much is ſufficient for our preſent Purpoſe; but in the

50th Figure I have given one general Rule, not only for determining the Center and Diſtance of each vaniſhing Line, but for finding the vaniſhing Line of any Plane, let its Inclination be what it will: All which ſhould be well remembered.

Having determined the Center and Diſtance of any vaniſhing Line, we are then to proceed with our Work in the very ſame Manner as in drawing the Repreſentations of Planes that lie flat upon the Ground; and, by turning the Figures, we may conceive every vaniſhing Line to be a horizontal Line, *&c.*

III. *To find the Repreſentation of a Square* abcd, *by the vaniſhing Points of its Diagonals, when it ſtands perpendicular to the Ground but oblique with the Picture, like* ABDF, *Fig.* 20. Fig. 33.

METHOD 1. *By drawing out a Square.*

Let ab, be the under Side given.—Continue ab to its vaniſhing Point O, and through O, draw IJ perpendicular to the horizontal Line; then is IJ the vaniſhing Line of the Square. Again, from E draw EO, which is the Diſtance of the vaniſhing Line IJ; therefore, ſet off O𝕰 equal to OE, and parallel to the horizontal Line draw a Line, as AB, at pleaſure; upon which, make a Square ABCD, and draw its Diagonals; then from 𝕰 draw Lines parallel to thoſe Diagonals, which will cut the vaniſhing Line in I and J; and then are I and J the vaniſhing Points of the Diagonals ac and bd.

METHOD 2.

Make at 𝕰, on each Side of the horizontal Line, an Angle of 45 Degrees, and draw 𝕰I, 𝕰J, which will produce the vaniſhing Points propoſed.

METHOD 3.

Or, the vaniſhing Points may be determined in this Example by making OI and OJ equal to O𝕰.

IV. *Suppoſe* abe *to repreſent the End of a Roof, as before; then the Sides of that Roof will be oblique with the Eye, like* abde, *Fig.* 34; *therefore, let us next find the Repreſentation of a Plane ſituated in this Manner.*

METHOD 1. *Let* ae *be the lower Edge of the Roof, which let us ſuppoſe to be a Square that reſts upon the Edge* ae. Fig. 34.

Continue the Side ae to its vaniſhing Point 𝕷, and draw L𝕰; then at E make a right Angle, and draw EH; and then is 𝕷 the vaniſhing Point of one Side of a Square which lies upon the Ground, and H the vaniſhing Point of another Side of the ſame Square; therefore, from the Corner a draw aH, and through H draw 𝔘L perpendicular to the horizontal Line; then is H the Center of the vaniſhing Line 𝔘L, and HE its Diſtance. Again, make Hℭ equal to EH, and make AC parallel to it; then upon AC draw the End of the Roof, (that is, the Angles of its Inclination) and from ℭ draw ℭ𝔘, ℭL, parallel to AB, CB, which will cut the vaniſhing Line 𝔘L, in the vaniſhing Points 𝔘 and L; and ſo will 𝔘 be the vaniſhing Point of the Edges ab, ed, and 𝔏 will be the vaniſhing Point of the Edges ae, bd, and L will be the vaniſhing Point of the Edge cb: And if a Line be drawn from 𝔘 to 𝔏, it will be the vaniſhing Line of the inclined Face aebd; from whence it is evident, that after we have found two vaniſhing Points of any inclined Plane, if a Line be drawn through thoſe Points, it will be the vaniſhing Line of that Plane. But to compleat the Repreſentation propoſed: Find the Center of the vaniſhing Line 𝔘𝔏, and ſet off its Diſtance upon the Perpendicular OI; then draw Lines from the vaniſhing Points 𝔘 and 𝔏, which will make a right Angle at the Eye; then biſect that Angle by the Line ID, which will give D for the vaniſhing Point of the Diagonal of a Square; by which means the Square aebd may be compleated.

METHOD 2. *By having the Width, as* ac, *of the Roof given.*

Let ac be the Width, or what is generally call'd *the Span*, of the Roof; and let 𝔘 and L be the vaniſhing Points of the Roof. ----From a, draw a𝔘, and through c draw Lb, cutting a𝔘 in b; then is abc the Repreſentation of one End. Again, from H draw HE, with which, at E, make a right Angle, and draw E𝔏; then is 𝔏 the vaniſhing Point of the Side ae which reſts upon the Ground; therefore, draw a𝔏 and b𝔏; then find the vaniſhing Point of the Diagonal of a Square, whoſe vaniſhing Points are H and 𝔏, and from a, draw aD, cutting b𝔏 in d; then from 𝔘 draw a Line through d, which will cut a𝔏 in e, and thereby compleat the Repreſentation propoſed.

METHOD 3. *By cutting off one Line equal to another Line given.*

From the Corner a draw af parallel to the vaniſhing Line 𝔘𝔏, and make af equal to one Side of the intended Square; then ſet off 𝔘F equal to 𝔘I, and draw Ff, cutting a𝔘 in b; and then is ab equal to af. Again, from a and b draw a𝔏, b𝔏, and from a draw ag parallel to the horizontal Line, and make it equal to af; then ſet off 𝔏G equal to 𝔏E, and draw Gg, cutting a𝔏 in e; then is ae equal to ag, that is, equal to af; therefore, draw e𝔙, which compleats the Square abed; finally, draw aH and bL, which will finiſh the whole Figure.

METHOD 4. *By having the vaniſhing Line 𝔙𝔏 given, at pleaſure.*

From the Center of the Picture draw CO perpendicular to the vaniſhing Line 𝔙𝔏, and ſet off the Diſtance of the vaniſhing Line from O to I, and let ab be one Side given.----Continue ab 'till it cuts the vaniſhing Line in its proper vaniſhing Point 𝔙, and from 𝔙 draw 𝔙I; then at I make a right Angle, and draw I𝔏; and then is 𝔏 the vaniſhing Point of the Sides ae, bd; and by finding the Point D, the Square may be compleated, as before. Again, for the upright End.----Continue the horizontal Line at pleaſure, and make 𝔙ℭ equal to 𝔙I, cutting the horizontal Line continued in ℭ; then is ℭH the Diſtance of the vaniſhing Line 𝔙L; by which means the vaniſhing Point L of the Side bc may be determined:---Or the vaniſhing Points of any Lines may be found upon 𝔙𝔏, by inſcribing a Figure at the Eye, like the original of our propoſed Repreſentation; as the Square I. Now what is ſaid of a Square, will ſerve for any other Figure; which, it is preſumed, is now ſo evident as to need no farther Explanation; eſpecially, ſince a little Practice will make all that has been advanced in this Section very eaſy and familiar.

Here let us obſerve, that when Objects are parallel to the Ground, they will have their ſeveral vaniſhing Points in the horizontal Line; when they are perpendicular to the Ground, they will vaniſh into a Line perpendicular to the horizontal Line, like Fig. 30, 31, 32, 33; when they are inclined to the Ground, but have ſome of their Edges parallel to the Picture, like ab, ed, Fig. 32, they will then vaniſh into Lines parallel to the horizontal Line; and will be above the horizontal Line when the Plane leans from the Eye, and below the horizontal Line when the Plane leans towards the Eye; but when the inclined Planes are every way oblique with the Picture, the Eye, and the Ground, like Fig. 34, then the vaniſhing Points of their ſeveral inclined Sides will vaniſh into Lines aſlant the horizontal Line, like 𝔙𝔏. Now, theſe being all the Variety of vaniſhing Lines which can ever happen in common Practice, it were needleſs to produce any other Examples of this Kind: But to aſſiſt the curious in determining the Repreſentations of Regular Solids,* or ſuch-like complicated Bodies, I have added the ſix following Figures; which may be omitted by the Generality of my Readers, as Things more curious than uſeful, and which are not in the leaſt eſſential to common Practice; and therefore, they are now referred to the next Chapter.

Fig. 35. V. *To find the Repreſentation of a Cube that reſts upon one of its Edges* ab.

EXAMPLE I. *When ſome of its Edges, as* ab, cd, fe, *are parallel to the Picture.*

Let ab be one Edge given, which let us ſuppoſe reſts upon the Ground. Now, becauſe the Edges ab, *&c.* are parallel to the Picture, therefore the End adfg will be perpendicular to the Picture; and conſequently, the vaniſhing Line VL of that End will paſs through the Center of the Picture, and will be perpendicular to the horizontal Line: And if we ſuppoſe the Diagonal af to be perpendicular to the Ground, then the vaniſhing Point of the other Diagonal de will be the Center of the Picture, becauſe it is parallel to the Ground. Therefore, through C draw the vaniſhing Line VL, and make C𝕮 equal to the Diſtance of the Eye; then at 𝕮 make a Square, in ſuch a manner that its Diagonal 1 2 may be parallel to the vaniſhing Line VL; or, which is the ſame thing, make the other Diagonal a Part of the horizontal Line; then draw 𝕮V and 𝕮L parallel to the ſeveral Sides of the Square, which will produce V and L for the vaniſhing Points of thoſe Sides.---This being premiſed, let us now compleat the Repreſentation, from the Side ab, which is given.----Through L, draw vl parallel to the horizontal Line, and make Ll equal to the Diſtance LJ of the vaniſhing Line vl; then from L draw Lines through a and b, and continue them at pleaſure; and from l, (which is the vaniſhing Point of the Diagonal) draw a Line through b, cutting Ld in d; then from d, draw dc parallel to ab, which will compleat the Face abcd. Again, from a and d draw Lines to V, and from d draw another Line to C, cutting aV in g; and from L draw a Line through g, cutting dV in f; which finiſhes another Face: Finally, from c draw cV, and from f draw a Line parallel to dc, which will cut cV in e, and thereby compleat the whole Repreſentation.

---

* Regular Solids, are Bodies terminated by regular Planes and are five in Number, *viz.* 1. the Tetrahedron; 2. the Hexahedron, or Cube; 3. the Octahedron; 4. the Dodecahedron; and 5. the Icoſahedron: The firſt of which is compoſed of four equal and equilateral Triangles; the ſecond, of ſix geometrical Squares; the third, of eight equal and equilateral Triangles; the fourth, of 12 regular Pentagons; and the fifth, of 20 equal and equilateral Triangles.

Again, When the End adfg ſtands in ſuch a Manner that the Diagonal af is perpendicular to the Ground; in this Caſe, the Angles at ℭ, made by the Sides of the Square with the horizontal Line, will be each equal to 45 Degrees; and therefore C is the vaniſhing Point of the Diagonal of the Square: But if the End be ſituated like the Square B, then draw a Square, repoſing upon one of its Corners on the horizontal Lines, in the ſame Manner as you ſuppoſe the End of the real Cube to be ſituated upon the Ground; after which, draw Lines from ℭ, parallel to the Sides of that Square, and then its Diagonals will cut the vaniſhing Line VL, continued, in the proper vaniſhing Points of thoſe Lines; thus, F and H are the vaniſhing Points of the Sides of the Square, and G is the vaniſhing Point of one of its Diagonals.

EXAMPLE 2. *When the Cube reſts upon one Edge* ab, *that is oblique with the Picture.* Fig. 36.

Continue ab to its vaniſhing Point 𝔏, and from 𝔏 draw a Line to the Eye E, with which make a right Angle; then draw EH, and through H draw 𝔙L perpendicular to the horizontal Line, and then is 𝔙L the vaniſhing Line of the End adef. Again, let H be the vaniſhing Point of the Diagonal ed; then, by making H𝔙 and HL equal to the Diſtance HE, we ſhall have the vaniſhing Points of the Edges ad, df, &c. and if from 𝔙 and 𝔏 we draw 𝔙𝔏, L𝔏, we ſhall have the vaniſhing Lines of the Faces abcd, cdfg. Again, find the vaniſhing Point D of the Diagonal bd, and from D draw a Line through b, then from L draw Lines through a and b, and then will Ld cut Dd in d, and thereby give ad for the Edge ad; therefore, from d draw d𝔏, which compleats one Face. In like manner, from a and d draw Lines to 𝔙, and from d draw dH, cutting a𝔙 in e; then from L draw a Line through e, cutting d𝔙 in f; and then we ſhall have compleated another Face adef: Finally, from f draw a Line to 𝔏, and from c draw a Line to 𝔙, which finiſhes the whole Figure.

EXAMPLE 3. *When the Cube ſtands upon one Corner, as* a. Fig. 37.

Let us ſuppoſe the Cube to ſtand in ſuch a manner, that a Line paſſing through the upper and under Corners will be perpendicular to the Ground; in which Caſe, a Plane aceh, that paſſes through thoſe Corners, will be perpendicular to the Ground alſo, and conſequently, its vaniſhing Line will be perpendicular to the horizontal Line: And let us, moreover, ſuppoſe, that this vaniſhing Line, as KI, paſſes through the Center of the Picture.---Any where, at pleaſure, draw a Square z and its Diagonals; then, upon the horizontal Line, draw a Perpendicular AE, at pleaſure alſo; and at the Point A, with the horizontal Line, make an Angle of 54 Degrees, and draw AH; then at A make another Angle CAD of 36 Degrees, and draw AC; and make AH equal to the Diagonal of the Square z, and AC equal to one of its Sides; then draw CE parallel to AH, and EH parallel to AC: So ſhall we have a Plane ACEH, which may be conſidered as the Original of the Repreſentation aceh; whoſe longeſt Side ah is inclined to the Ground at an Angle of 54 Degrees, and whoſe ſhorteſt Side is inclined to the Ground at an Angle of 36 Degrees; which together make a right Angle; that is, one Angle of a Square. Now, having made theſe neceſſary Preparations, let a be the Corner upon which it ſtands.---Set off the Diſtance of the Eye CE, and draw KI through C; then from E, draw EK parallel to AH, (Fig. X) and EI parallel to AC, (Fig. X) cutting KI in I and K; then are I and K the vaniſhing Points of the Plane aceh. Again, through K draw 𝔘𝔏 parallel to CE, which will give the vaniſhing Line of the upper Face cdef; and ſince K is the vaniſhing Point of its Diagonal ce, therefore, by making K𝔘, and K𝔏, each equal to the Diſtance EK, we ſhall have the vaniſhing Points of the Sides cf, cd, &c. by which means that Face may be compleated. Then let ce be the Diagonal given.---From c draw c𝔘, c𝔏, and from 𝔘 and 𝔏 draw Lines through e, which will produce the Face propoſed. Again, having two vaniſhing Points 𝔘 and I, of the Face abcd.--Draw 𝔙I, which is its vaniſhing Line; and by finding the Center O, and its Diſtance O𝔈, together with its vaniſhing Point H of the Diagonal bc, the Face abcd may be compleated. The ſame may be ſaid of the other Face acfg. The Figure K is drawn in ſuch a manner, as to ſhew all the Faces of a Cube in the above Situation.

Let us now, without any Regard to a particular Situation of the Cube, ſuppoſe ab one Edge given, 𝔙 its vaniſhing Point, and 𝔙I its vaniſhing Line; and let C be the Center of the Picture, and CE its Diſtance.--Find the Center and Diſtance of the vaniſhing Line 𝔘I, and draw 𝔙𝔈; then, at 𝔈 make a right Angle, and draw 𝔈I;

and then will I be the vaniſhing Point of the Edge ae; and by finding the vaniſhing Point H of the Diagonal bc, the Face abcd may be compleated. For from the vaniſhing Point I, draw a Line through the Center of the Picture, and continue it at pleaſure, (as IK;) then from C draw a Line perpendicular to IK, and make CE equal to the Diſtance of the Eye; then draw IE, and at E make a right Angle; then draw EK, cutting IK in K; finally, through K draw a Line parallel to CE, which will paſs through the vaniſhing Point 𝔄, and produce the vaniſhing Line 𝔄𝔏 of the Face cdef. Again, from 𝔏 and I draw 𝔏I, which will give the vaniſhing Line of the other Side acfg.

I have dwelt the longer upon this laſt Figure, as it is a very curious Example, and, as it were, opens the Way to the Projection of all the regular Solids.

EXAMPLE 4. *To find the Repreſentation of a regular Tetrahedron, repoſing upon one of its Faces.*

Fig. 38.

This alſo may be done eaſieſt by finding a perpendicular Plane which is ſuppoſed to paſs through the Middle of the Body, as ade.—Now in order to find the Inclination of the Sides of this perpendicular Plane, draw an Equilateral Triangle AGF, and divide the Side GF into two equal Parts, and draw AE; then at E, with the Diſtance EA, deſcribe an Arc; and at A, with the Diſtance AG, deſcribe another Arc, cutting the former Arc in D; then draw AD, ED; and then will AD be the Inclination of the Edge ab, and is 55 Degrees; and ED is the Inclination of the Edge ed, and is 70 Degrees. Having thus got the Inclination of the above Edges, the next thing is to find the Repreſentation of the Face abc, the vaniſhing Points of whoſe oblique Sides are H,L.----Biſect the Angle HEL, and draw EC; then is C the vaniſhing Point of a Line that will divide the Side bc into two equal Parts; and therefore C is the vaniſhing Point of ae, that is, of the Bottom of the perpendicular Plane ade. Again, through C draw 𝔄D perpendicular to the horizontal Line, and continue it at pleaſure; and then is 𝔄D the vaniſhing Line of the Plane ade: Then at E, the Diſtance of the vaniſhing Line 𝔄D, make an Angle with the Line CE equal to 55 Degrees, and draw E𝔄; and then is 𝔄 the vaniſhing Point of the Edge ad. Again, make another Angle at E of 70 Degrees; and draw ED; and then is D the vaniſhing Point of the Side de, by which means the Plane ade may be compleated; and by drawing bd, and cd, the whole Figure will be finiſhed.---Or it may be done by making the Figure ADE in ſuch a manner that AE may be parallel to the horizontal Line; for then, by drawing E𝔙, and ED, parallel to AD, and DE, the vaniſhing Points 𝔙 and D will be produced.---Or this Figure may be found by having only the Inclination of the Edge ad, which, we obſerved before, was an Angle of 55 Degrees. Thus, make an Angle of 55 Degrees at E, and draw E𝔙; then ſince H is the vaniſhing Point of the Edge ab, and 𝔙 is the vaniſhing Point of the Edge ad, therefore by drawing 𝔙H, and continuing it at pleaſure, we ſhall have the vaniſhing Line 𝔙𝔏; and by finding the Center and Diſtance of that vaniſhing Line, and making two Angles of 60 Degrees each at ℭ, we ſhall have the vaniſhing Points of all the Edges of the Side abd; and conſequently, by joining dc, the Figure will be compleated.---What is ſaid of the vaniſhing Line 𝔙𝔏, may be ſaid alſo of the other vaniſhing Line 𝔙l.*

EXAMPLE 5. *To put a Canted Cube* † *into Perſpective, reſting upon one of its Square Faces.*

Let ac be one Edge of its under Face, A its vaniſhing Point, and H the vaniſhing Point of another Edge of the under Face; that is, let A and H be the vaniſhing Points of a Square that lies flat upon the Ground.---Through H draw FI perpendicular to the horizontal Line, and make Hℭ equal to the Diſtance of the vaniſhing Line FI. Then at ℭ, on one Side of the horizontal Line, make an Angle of 45 Degrees, and draw ℭF, ℭI; then from F and I, draw FA, IA; and then is IA the vaniſhing Line of the Face abcd; therefore, by finding the Center and Diſtance of this vaniſhing Line, and by that means the vaniſhing Point K of the Diagonal bc, the Square abcd may be compleated.---In like manner, it is eaſy to ſhew, that FI is the vaniſhing Line of the Face g; GM the vaniſhing Line of the Face h; 𝔏N the vaniſhing Line of the Face b; BD the vaniſhing Line of the Face f; FA the vaniſhing Line of the Face k; FN the vaniſhing Line of the Face i; H𝔏 the vaniſhing Line of the Face m; and 𝔙N the vaniſhing Line of the Face e.

---

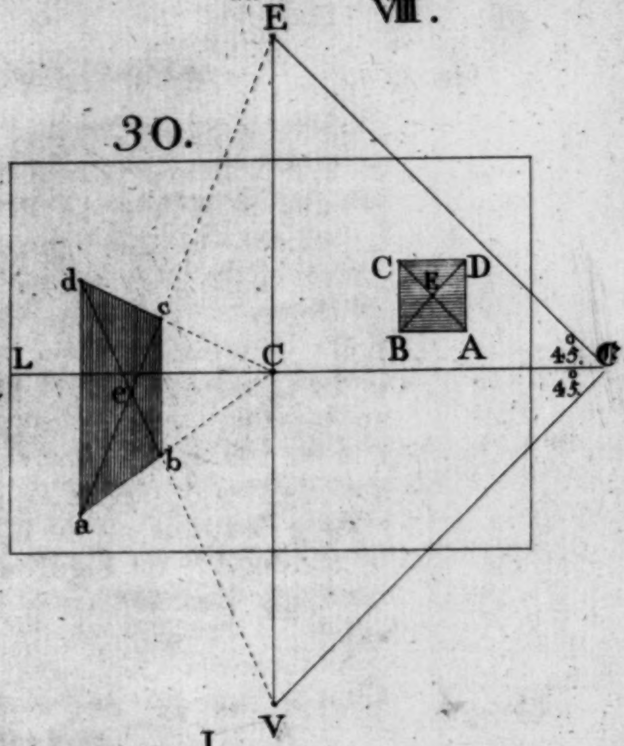
* Theſe two Examples are ſufficient to point out the Method for determining the Repreſentation of all the regular Solids; for having got the Inclinations of their ſeveral Planes, *&c.* their peculiar vaniſhing Lines and Points may be found with the greateſt Eaſe.

† A Canted Cube, is a ſolid Body comprehended under 18 Geometrical Squares and eight equal and equilateral Triangles.

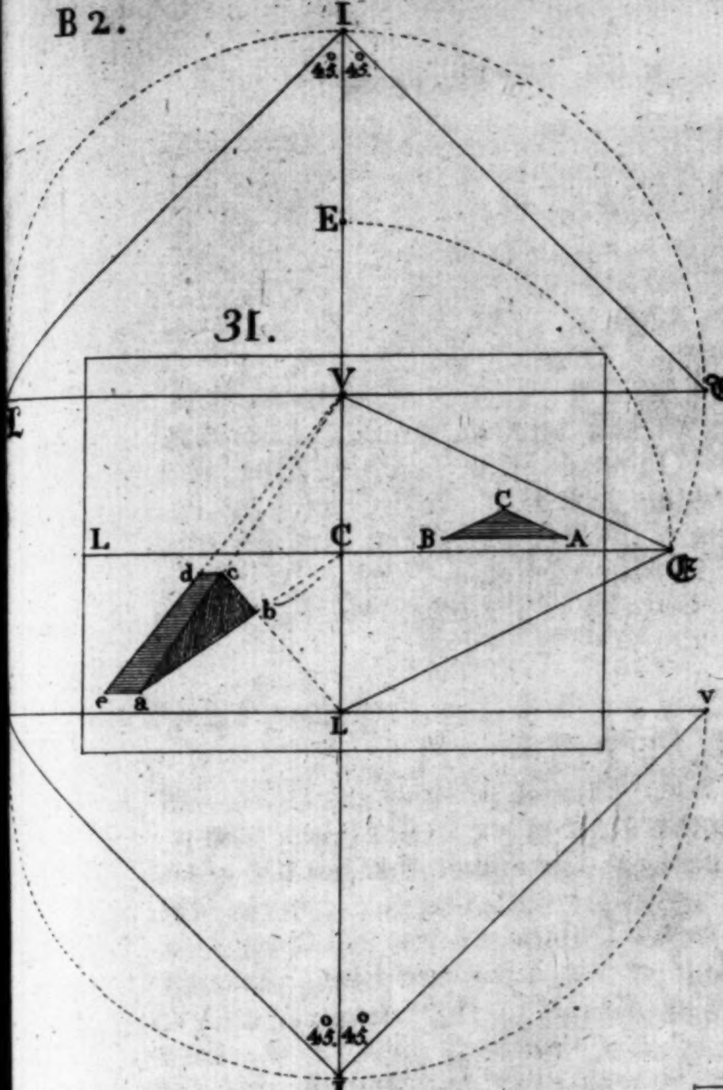
B 2.

VIII.

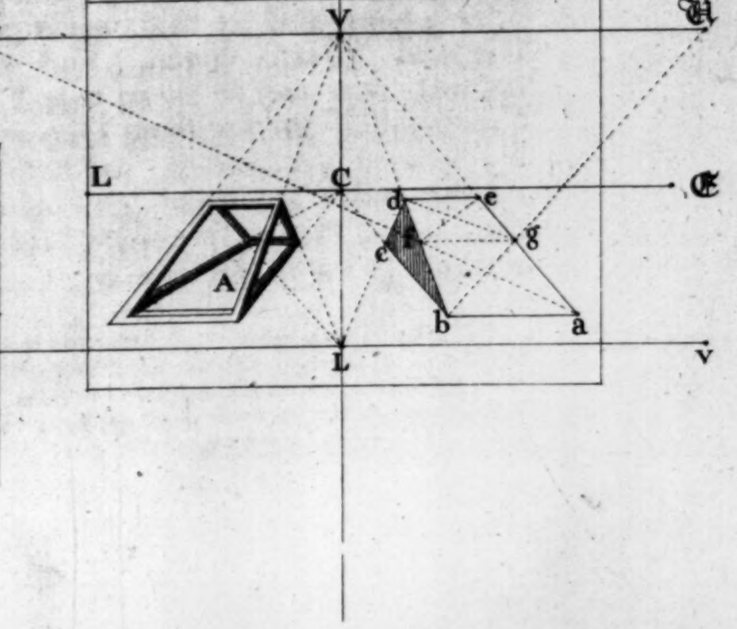
30.



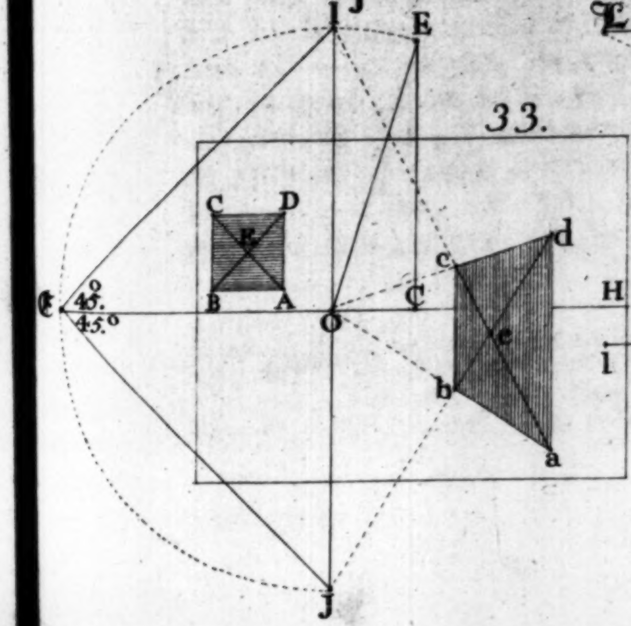
31.



32.

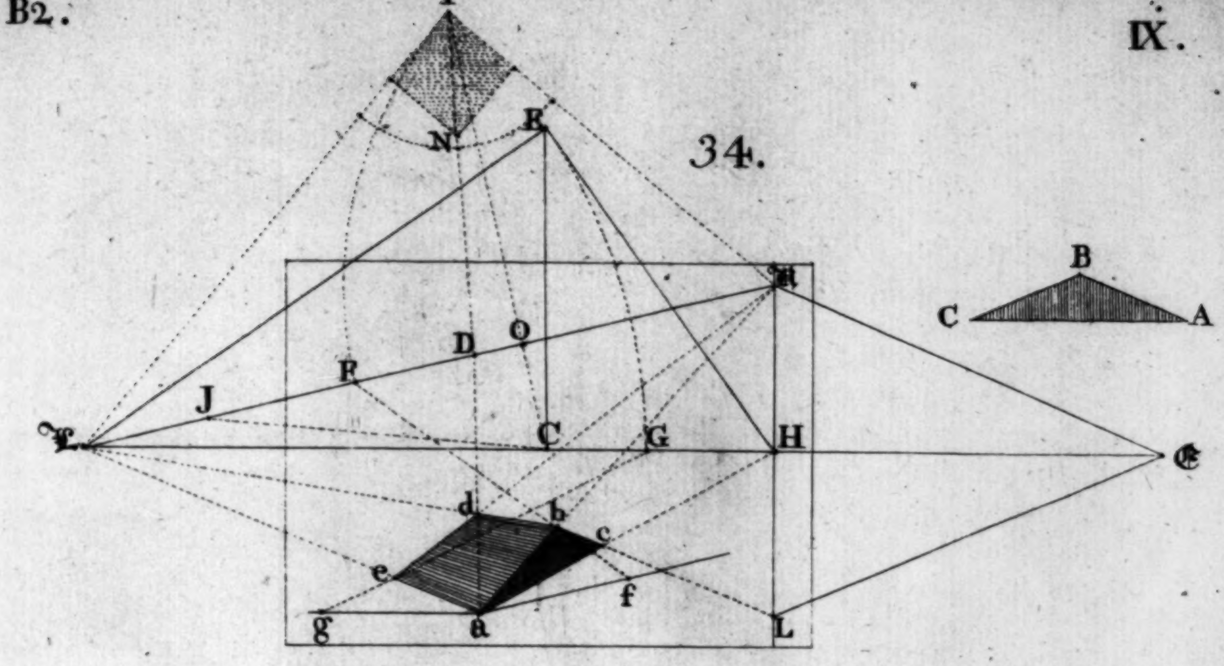


33.

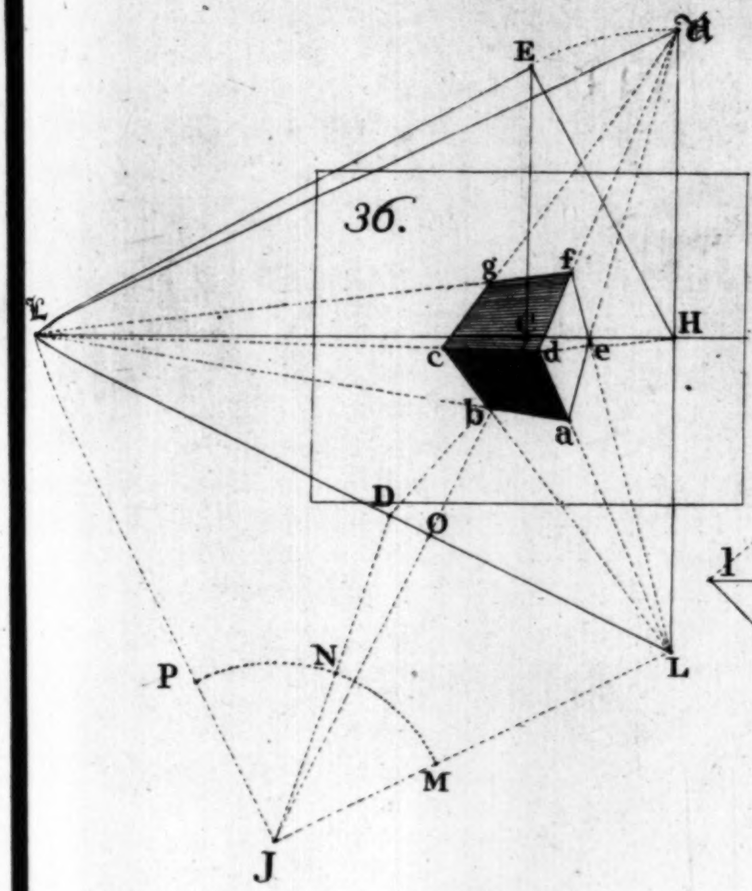


BRITISH 1 JY64 MUSEUM

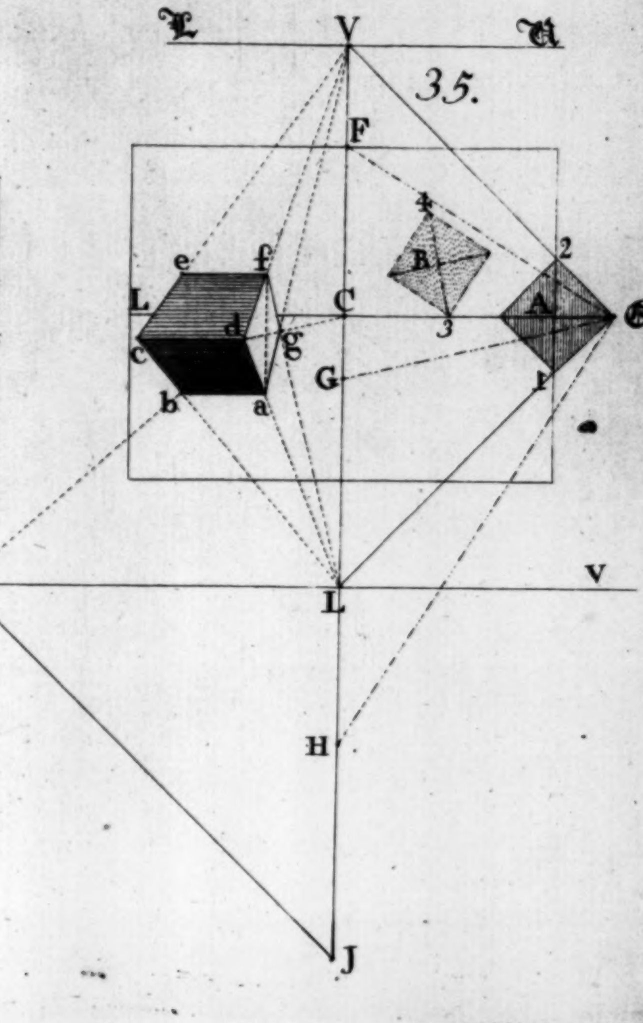
34.


I
N
E
D
O
F
J
𝔏
C
G
H
𝔈
𝔄
d
b
c
e
f
g
a
L
B
C
A

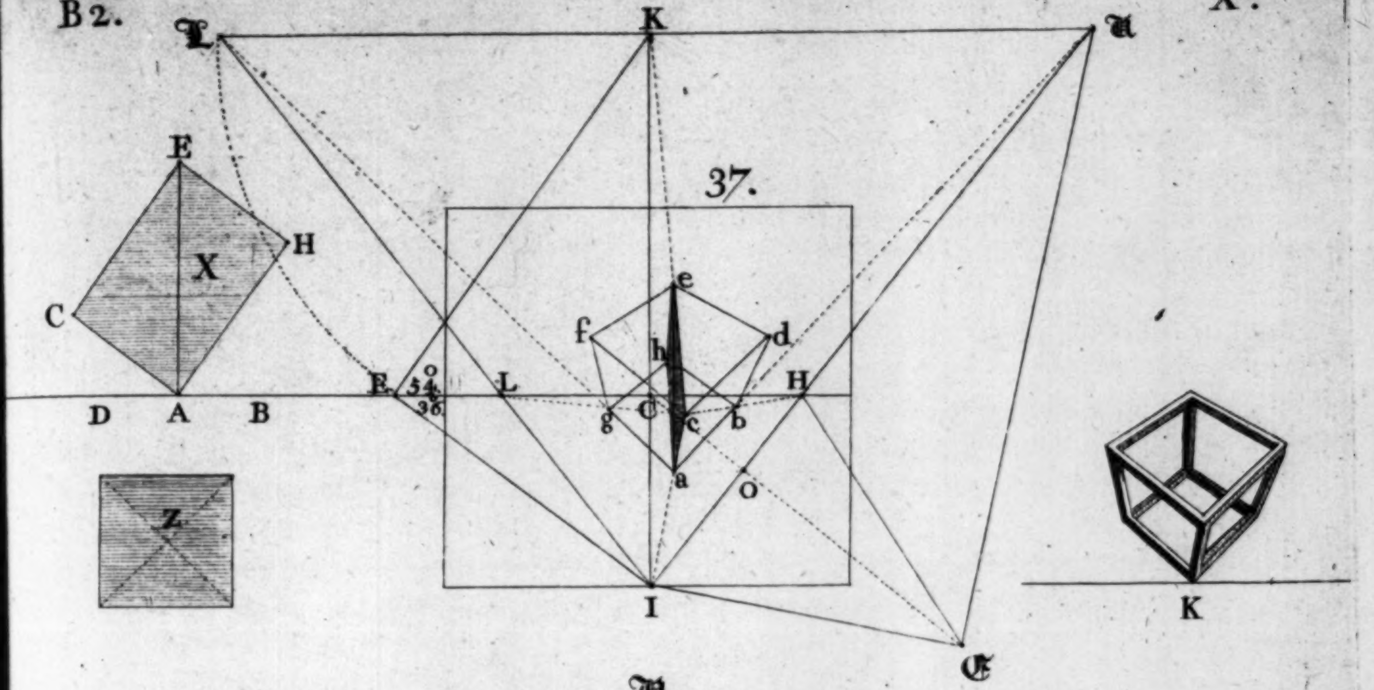
36.


𝔄
E
g
f
𝔏
H
c
d
e
b
a
D
O
L
P
N
M
J

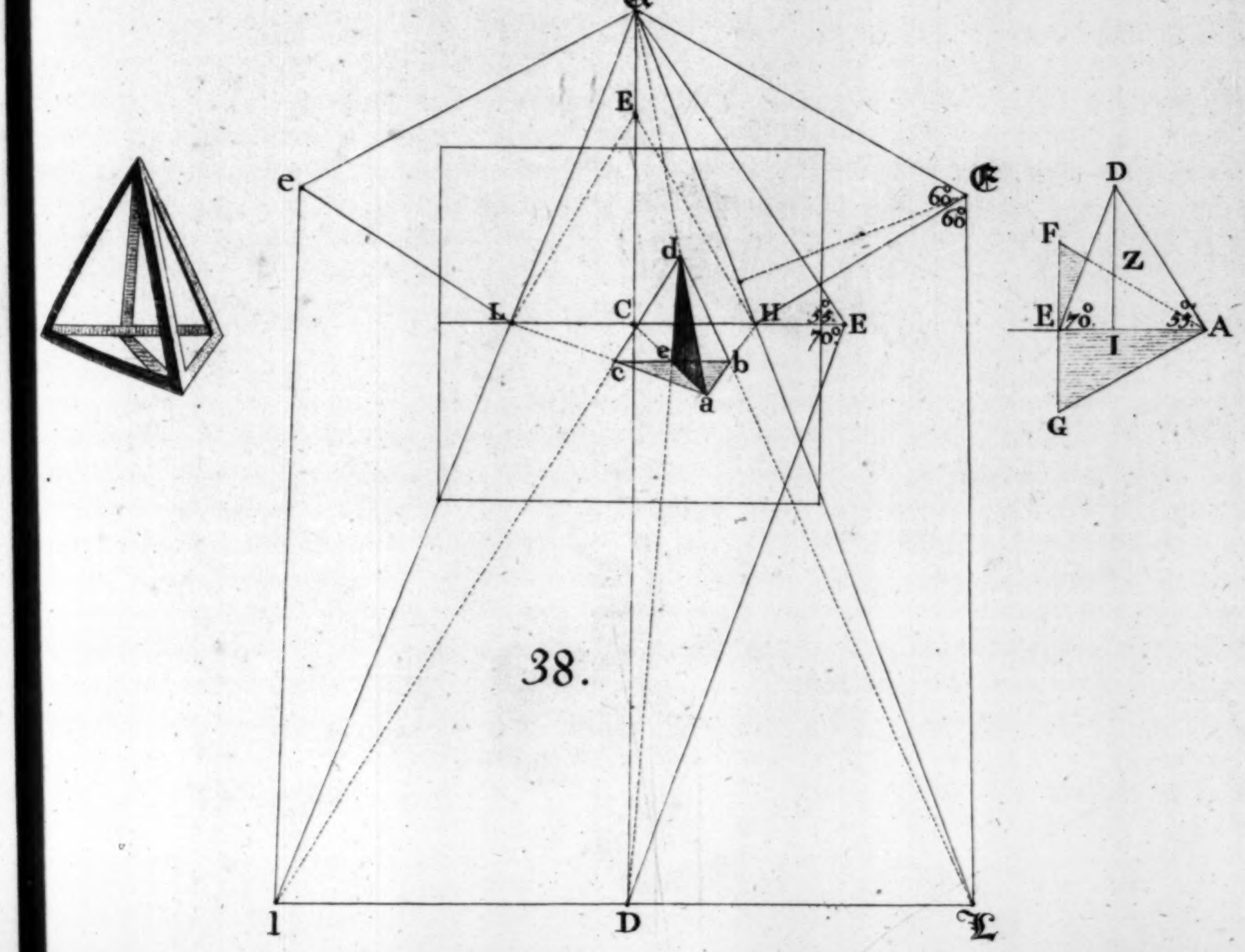
35.


𝔏
V
𝔄
F
4
B
2
e
f
L
C
A
𝔈
c
d
g
3
G
b
a
1
l
v
L
H
J

BRITISH
1 JY64
MUSEUM


37.

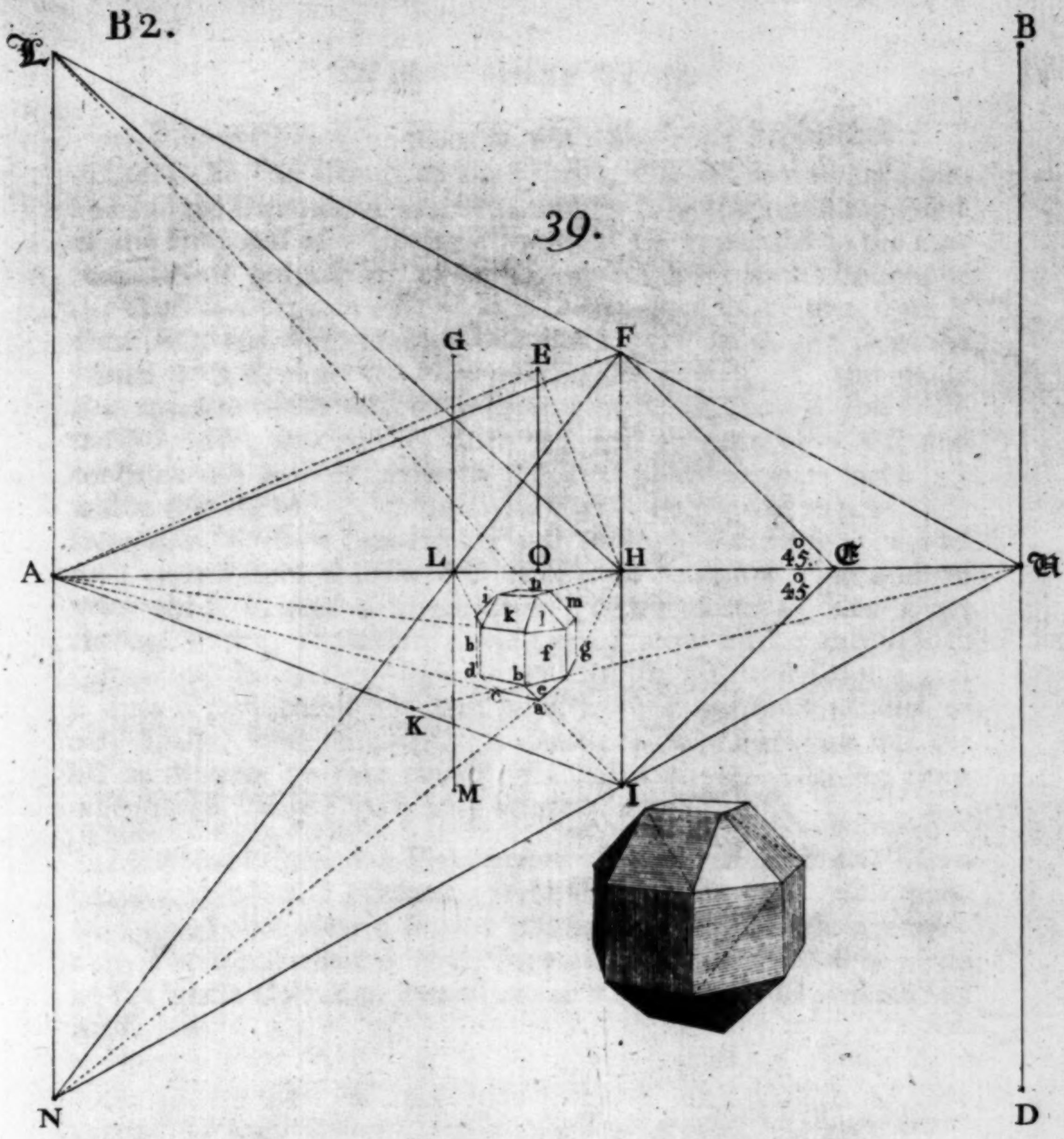
𝔏
K
𝔄
E
H
X
C
D
A
B
Z
e
f
d
h
E
54°
36°
L
H
g
C
c
b
a
O
I
𝔈
K


38.

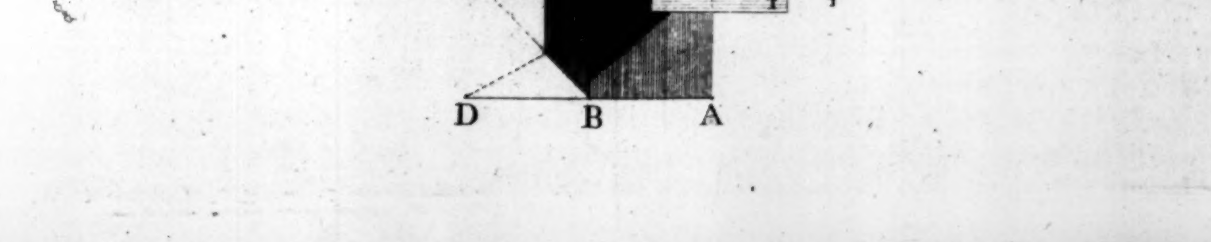
𝔄
E
e
𝔈
60°
60°
d
L
C
H
55°
70°
E
c
e
b
a
D
F
Z
E
70°
55°
A
I
G
l
D
𝔏

BRITISH
1 JY64
MUSEUM

39.


𝔏
B
G
E
F
A
L
O
H
45°
45°
𝔈
𝔄
i
n
m
k
l
b
f
g
d
b
c
e
a
K
M
I
N
D

40.


C
L
k
E
o
n
m
b
8
p
4
e
7
6
s
f
q
D
B
A

BRITISH
1 JY64
MUSEUM

EXAMPLE 6. *To put a double Croſs into Perſpective.*

Fig. 40. Let C be the Center of the Picture, CL the horizontal Line, and LC the Diſtance of the Eye; and let L be the vaniſhing Point of the Diagonal of a Square whoſe Side AB is parallel to the Picture.—Now ſuppoſe AB to be the neareſt Edge of the Bottom of the Croſs.—Continue AB, and make BD equal to it; then from B draw BC, and from D draw DL, cutting BC in a; and from the Points A, B, a, draw the Perpendiculars An, Bm, ak, and make Bm equal to thrice AB; then draw nm parallel to AB, and finiſh the Top nk; after which, draw 23 and s1 parallel to AB, and continue 23 and s1 on both Sides, at pleaſure; then make 34 and 25 equal to 32, and draw 49 and 56 parallel to nA; then from 4, 2, 5, draw Lines to C; and through i draw p8 parallel to 45, and from 6 draw 6C, then from 8 draw 87, parallel to 56; which finiſhes a ſingle Croſs. Again, from C draw Lines through 1, 2 3, at pleaſure; and from L draw a Line through 3, cutting cC in c; then draw ce parallel to 32, and from e and c draw efcd parallel to 12; then from d draw df parallel to ec; finally, from the Corner 8 draw a Line to L, which will cut iC in b, and by that means give the fartheſt Corner b; from whence the whole Figure may be compleated.

I have added this laſt Figure, to ſhew the vaſt Eaſe and Expeditiouſneſs of this Method, preferably to any yet made publick, and I ſhall have a further Uſe for it in another Place; however, I will juſt obſerve, that there are no more than four Lines in the whole Operation but what are a Part of the Repreſentation itſelf.

CHAP. III.

The Practice of Perſpective abbreviated.

SECT. I.

General Rules, &c.

IN the laſt Chapter I have given ſome general Rules, and have explained them by the moſt uſeful Examples, ſo that the whole Practice of Perſpective might be deduced therefrom by any one who will conſider them with a proper Attention; but leſt their Application, in general, ſhould not appear ſo eaſy as could be wiſhed, (and to ſpare the Learner as much Trouble as poſſible) I ſhall in the firſt Section of this Chapter, collect all the Rules together in their proper Order, and then, in the ſecond Section of this ſame Chapter, I ſhall apply them more particularly to common Practice.

Fig. 41. I. *Having one Line* AB *given, whoſe vaniſhing Point is out of the Picture, from thence to draw another Line* CD, *which ſhall tend to the ſame Point.*

From the Point A draw AC at pleaſure, and at any convenient Diſtance, (the farther the better) draw BD parallel to AC.—Now let AC repreſent the Corner of any Building, and C the Top of it; and let it be required to draw a Line, as CD, which is ſuppoſed parallel to AB.—Make B6, which is below the horizontal Line, in the ſame Proportion to 6D, which is above the horizontal Line, as A2 is to 2C; that is, ſuppoſe 2A two equal Parts, and 2C three equal Parts; then divide the Space 6B into two equal Parts, and make 6D equal to three ſuch Parts, and then draw CD, which will, if continued, vaniſh into the Point E. And by proceeding in the ſame Ratio, any other Line may be drawn, either above or below the horizontal Line.

1. *When 'tis below the Horizontal Line, to draw a Line, as* 1 5, *which tends to an inacceſſible Point* E.

Let AB be the given Line.----Draw A2, B6, parallel to each other, and divide them in the ſame Proportion; thus, let A2 be divided into two equal Parts, then divide B6 into two equal Parts alſo, and a Line, as 1 5, which is drawn through the Points 1, 5, will vaniſh into E.

2. *When*

2. *When it is above the Horizontal Line, as* 4 8.

Here CD is the Line given, and 'tis required to draw 4 8 in ſuch a manner that it ſhall cut off one-third of the Plane C2 6D. Divide 2C and 6D each into three Parts, and draw 4 8; which is the Thing propoſed.---Theſe Rules are applied to Practice in the 13th, 21ſt, and 23d Figures.

II. *To make one Line equal to another Line given.*

Fig 42. This may be done by giving a Line, as ac, parallel to the horizontal Line.---For let cH be an indefinite Repreſentation, Part of which is to be cut off equal to ac. From H, ſet off HI equal to HE, and draw aI, which will cut off bc equal to ac.----And ſuppoſe it were required to find the Length of any Line which is in an inclined Plane, then the very ſame Method is to be uſed. Thus, in Fig. 44, let V be the vaniſhing Point of ab, and VL the vaniſhing Line of an inclined Plane, in which ab is ſuppoſed to lye. ---Find the Center C of that vaniſhing Line, and its Diſtance CE; then make V2 equal to the Diſtance EV of the vaniſhing Point V, and from a, draw ac parallel to the vaniſhing Line VL, and make it equal to the propoſed Length, and then draw 2c, cutting aV in b; which will give ab equal to ac. Again, to make one Line, df, equal to another Line cb, which is given. Fig. 42. Let H be the vaniſhing Point of cb, and C the vaniſhing Point of df.---From the Points H and C, deſcribe the Arcs IE, LE; from c draw ac parallel to the horizontal Line; and from I draw a Line through b, cutting ac in a; then is ac equal to cb: For continue ac 'till it cuts Cd in d, and make ed equal to ac; then draw eL, which will cut off df equal to cb.*

III. *To cut off a Line in any given Proportion.*

Fig. 43. Let a Line be drawn parallel to the horizontal Line, and continued at pleaſure; and let it be required to cut off ac equal to three Feet.---Thro' one End, as a, draw a Line 3 4, cutting the Bottom of the Picture in 4, and the horizontal Line in 3; then ſet off 3 1 equal to the Diſtance 3E; and from 1 draw a Line through a, cutting the Bottom of the Picture in e; then from e ſet off three Feet upon the Bottom of the Picture, (as eh) and draw h 1, cutting ac in c; ſo will ac be equal to three Feet.---Again, To cut

off an oblique Line, as ab, equal to three Feet.—Set off the Diſtance 3 1, and from e and h draw e 1, h 1, cutting a 3 in a and b; then is ab equal to three Feet.---Or this may be done without taking the whole Diſtance 3E: Thus, take half the Diſtance, as 3 2, and divide the given Line ac in the ſame Proportion, that is, into two equal Parts, and draw f 2, which will cut off ab equal to ac. After the ſame Manner, a Line may be divided into any Number of Parts, or be made of any given Length; for by ſetting the real Proportions upon the Bottom of the Picture, it may ſerve as a general Scale for regulating the apparent Size of any Perſpective Repreſentation: Thus, ab, or ac, may be divided into three Parts each, or three Feet, by dividing eh, and then drawing Lines to 1, in the above Manner.—Theſe Rules are particularly applied to Practice in the 18th, 19th, and 20th Figures.

---

* Theſe Methods are applied to practice in ſeveral of the preceding Figures.

What is here ſaid in regard to the cutting off Lines in any given Proportion, when thoſe Lines vaniſh into the horizontal Line, is equally applicable to Lines in all Kinds of inclined Planes. For let VL be a vaniſhing Line of an inclined Plane, and V the Fig. 44. vaniſhing Point of a Line ab in that Plane.—Continue Va to the Bottom of the Picture in B, and from B draw AB parallel to the vaniſhing Line VL, and continue it at pleaſure; then, upon this Line AB ſet off the ſeveral Meaſures, as if it were the Bottom of the Picture, and conſider VL as the horizontal Line, C as the Center of the Picture, and CE as its Diſtance; and then the Operation will be the ſame as in the laſt Figure.—This alſo is applied to Practice in the 34th Figure.

IV. *Having ſketched-in the propoſed Size for an Object upon the Picture, to prove whether it be diminiſhed in Proportion to its Diſtance.*

Fig. 45. Let ab repreſent the Height of an Object.---From any Point, as H, in the horizontal Line, draw Lines through the Extremities a and b of the Figure, and from C, where the loweſt Line cuts the Bottom of the Picture, draw the Perpendicular CB; then make this Line a Scale, the ſame as if it was the Bottom of the Picture, and that will ſhew whether the Figure be in Proportion for the Place it poſſeſſes in the Picture, or not: Thus, ſuppoſe the Height is 20 Feet; then gf is too much, and cd too little. Thus again, Fig. 46. ſuppoſe the Object to be a Houſe, I ſay, the Height ab may be proportioned to its Diſtance by the above Rule; for by drawing the Lines 5 1, 5 2, and the Perpendicular 1 2, we may eaſily determine its proper Height, as in the Figure.---This is likewiſe applied to Practice in abcd, Fig. 18.

V. *To find the Length of any Repreſentation by Calculation only.*

Let AB be a real Line whoſe Repreſentation is ſought, and CE the Diſtance of the Eye; which, in this Caſe, is parallel to AB.---Make Ba in the ſame Proportion to Ca, as AB (the real Line) is to CE, the Diſtance of the Eye: Thus, let AB, be two Parts, and CE three Parts (or, if you pleaſe, ſo many Feet;) then divide AC into five equal Parts, and the Repreſentation Ba of BA, will be two of thoſe Parts; that is, as 2 is to 3: For draw AE, which will determine the Repreſentation of AB; as in the 5th Figure. In like Manner, ec is to cC, as 2 is to 3; or, if you pleaſe, ec is to the whole Line eC, as 2 is to 5. And ſo alſo for any oblique Line, as DF: For Dd is to dL, as DF is to LE. Or this may be determined, without taking the whole Diſtance, by Analogy. Thus, half the Diſtance of CE, as C 1, and half the Length of AB, as A2, will come to the ſame thing; for draw 2 1, and it will paſs through the Point a.---The next Figure is a farther Explanation of the ſame thing, but by a different Method. Fig. 47.

VI. *To find the Diſtance of the Picture from having two vaniſhing Points of a Square given.*

Let VL be the horizontal Line, C the Center of the Picture, and V, L, the vaniſhing Points of the Square.---Divide VL into two equal Parts, in A, and with the Diſtance AV deſcribe the Semi-circle VEL; then from C draw the Perpendicular CE, cutting the Semi-circle in E; and then is CE the Diſtance of the Picture. For draw VE, LE, and they will make a right Angle at E. Fig. 49.

VII. *To find the vaniſhing Line of any inclined Plane, and their proper vaniſhing Points, together with the Center and Diſtance of thoſe vaniſhing Lines.*

1. *When the Plane is inclined to the Ground, but has ſome of its Sides parallel to the Picture, like* acde, *Fig.* 31.

In this Caſe, the Rules are laid down and fully explained by that Figure.

2. *When the Plane is not only inclined to the Ground, but has all its Sides oblique with the Picture, like* a b d e, *Fig.* 34.

In this Figure alſo, the Rules are fully explained. And theſe are all the Rules which are neceſſary in common Practice, as I have obſerved before; nevertheleſs, to aſſiſt the Curious, I have added the following Figure.

Fig. 50. VIII. *Having given one Side of any inclined Plane, at pleaſure, together with its vaniſhing Point, and the vaniſhing Line of that Plane, thence to determine the whole Repreſentation.*

Let VU be a vaniſhing Line given, and ſuppoſe V the vaniſhing Point of one Edge of a Square, (as ae, Fig. 36) and let C be the Center of the Picture, and CE its Diſtance.----From V, the given vaniſhing Point, draw a Line through the Center of the Picture, as VD, and continue it at pleaſure; then from C draw CI perpendicular to VD, and make CI equal to the Diſtance CE, and from V draw VI; then at I, draw Ic perpendicular to VI, cutting VD in c; and parallel to IC draw LU, cutting VU in U; then is UL the vaniſhing Line of a Plane perpendicular to that Plane, whoſe vaniſhing Line is VU; that is, VU and LU, in this Figure, are the ſame as 𝔘L and 𝔏L in the 36th Figure, where the Plane abcd is perpendicular to the Plane adfe. Again, Suppoſe the Angle which another Plane made with the Plane whoſe vaniſhing Line is VU, was a different Angle (ſuppoſe 60 Degrees) and it was required to find its vaniſhing Line.---Then, as before, draw a Line VD through the Center C of the Picture, and find the vaniſhing Line LU of a Plane perpendicular to that Plane, whoſe vaniſhing Line is VU; after which, continue cD at pleaſure, and make cD equal to the Diſtance Ic of the vaniſhing Line LU; then draw DU, with which make an Angle at D equal to 60 Degrees, and draw D𝔏; finally, draw V𝔏; and then will V𝔏 be the vaniſhing Line propoſed.---Again, to find the Center and Diſtance of a vaniſhing Line.---From the Center of the Picture, draw a Line perpendicular to any vaniſhing Line, which will give the Center of that vaniſhing Line: Thus, CH and Cc are perpendicular to VU and LU, and therefore H and c are the Centers of thoſe Lines.---Again, for the Diſtance of a vaniſhing Line.----Upon the Perpendicular Cc, and at the Center C, draw another Perpendicular CI, and make CI equal to the real Diſtance CE; then draw Ic, which will be the Diſtance of the vaniſhing

Line LV, which being transferred unto Cc continued, as cD, will give the proper Diſtance to be work'd with.

IX. *The following is a Method for finding the Repreſentation of the Plan of any Building, &c. when the Diſtance to be work'd with is not greater than from the Center to one Corner of the Picture, as* CE. Fig. 51.

Draw CE; perpendicular to which, draw Kl through C; which conſider as the Bottom of the Picture. Under Kl draw out the real Figure in its proper Situation, as ABC; then from the tranſpoſed Place of the Eye, draw Lines parallel to the ſeveral Sides of the Figure, which will give H and l for the vaniſhing Points of thoſe Sides, and which are to be tranſpoſed into the horizontal Line, as H and L; after which, draw the Perpendicular CM, and from M ſet off the ſeveral Diſtances CF, CG, &c. upon the Bottom of the Picture; and then, by drawing Lines to the proper vaniſhing Point of each Line, as in the Figure, the whole Repreſentation may be compleated, exactly in the ſame Manner as if the original Figure had been drawn out under the Picture.

In the next Place, I ſhall ſhew how to determine the Appearance of thoſe Sorts of Objects which moſt frequently occur in common Practice; for this will explain more fully the Uſe of the preceding Rules, and at the ſame Time, will ſhew the Shortneſs and Expeditiouſneſs of this Method of Perſpective. And as I have by former Examples, ſo I ſhall likewiſe, in the next Section, make uſe of ſuch Objects as are ſimple in their Parts, and of the moſt general Uſe. To explain myſelf more fully. A Pedeſtal, for inſtance, is but one Part of an Order in Architecture, and the Idea we have of it is, of its being the Baſe, or Support, of a Column; but by enlarging the Idea of a Pedeſtal to that of a large ſquare Building, enriched with Mouldings, &c. we may then conſider it as ſuch a Building; and therefore, we may conceive, that the ſame Rules by which the Appearance of a Pedeſtal is determined upon the Picture, will ſerve for finding the Repreſentation of any Building which is ſimilar to it. In like manner, as to the Situation of Objects which are perpendicular to the Ground, (ſuch as the Walls of Buildings, and the like) they muſt be either perpendicular to the Picture, parallel to the Picture, or oblique with it; as we have ſhewn before: And therefore, one Example in each Situation, adapted in a general Manner, will be of much more Service than ten thouſand different Schemes by way of Examples; for the one fixes our Attention to a particular Set of uſeful and general Ideas, but the other diſtracts the Mind with Confuſion and Obſcurity.

The ſame Arguments will appear equally true, if we apply them to the particular Parts of any Building, ſuch as Columns, Mouldings, and the like. For, firſt, in regard to Columns; by this Method, we have no Regard to Plans, Elevations, &c. and therefore, it matters not where we begin the Operation, whether at the Top, the Bottom, or at the Middle of it; ſo that one Rule alſo in this Caſe will appear to be univerſal: And in reſpect to Mouldings, they muſt be either plain or curvilinear, either above or below the Eye; and therefore, one Rule in either Caſe will be ſufficient for our Purpoſe. The ſame may be ſaid of every other Example in this Section; but what has been ſaid already, will, I hope, be ſufficient to explain the Senſe of the following Figures, and to ſilence any Objections which may be made againſt my not having ſwell'd my Work with more ornamental Schemes, or, as they are generally called, Curious Examples.

The firſt Example which I ſhall produce, is the TUSCAN PEDESTAL, in order to ſhew how to find the Repreſentation of ſtrait Mouldings, when they are either parallel, perpendicular, or oblique with the Picture, or when they are either above or below the Eye. In the 52d Figure one Side is parallel to the Picture, the other perpendicular to it; and in the 53d Figure, both Sides are oblique with the Picture.

SECT. II.

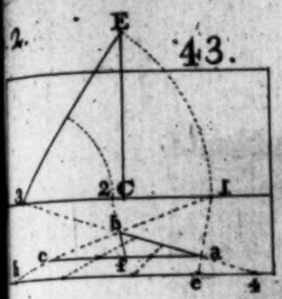
The foregoing Rules of Perſpective more particularly applied to common Practice.

I. *To put a* TUSCAN PEDESTAL *into Perſpective.*

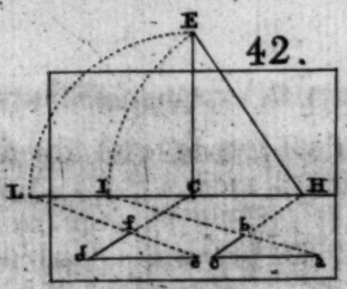
1. *When one of its Sides is parallel to the Picture, then the other Side will be perpendicular to it; ſo that one Rule will do in both Caſes.*

Fig. 52. LET AB repreſent the Bottom of the Plinth in Front.---Now, from this one Line AB, the Appearance of the whole Pedeſtal may be found: For continue AB at pleaſure, and draw a Line IK perpendicular thereto, and make IK equal to the Height of the Pedeſtal; then, upon IK, draw the Capital and Baſe in their proper Proportions: This being done, continue Lines from each Moulding,

43.

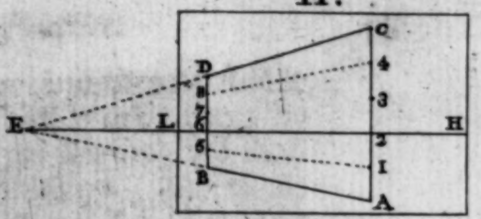


42.

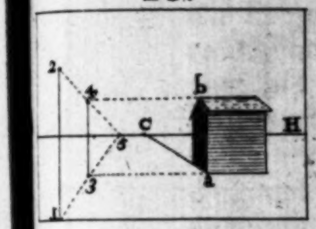


XII.

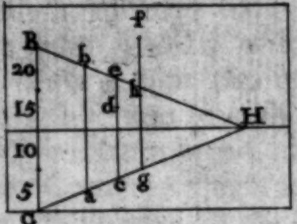
41.



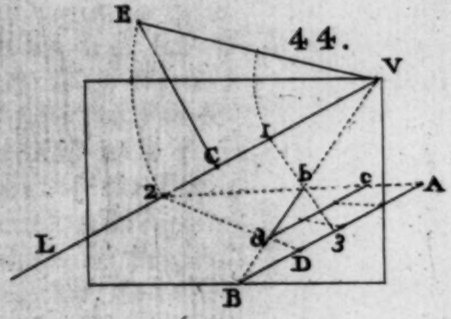
46.



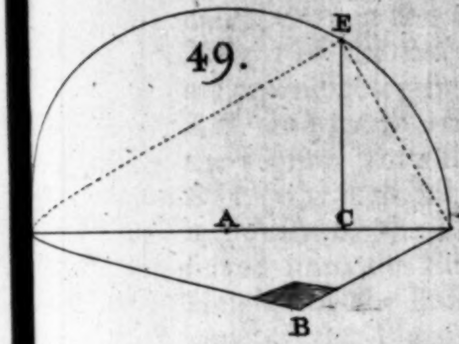
45.



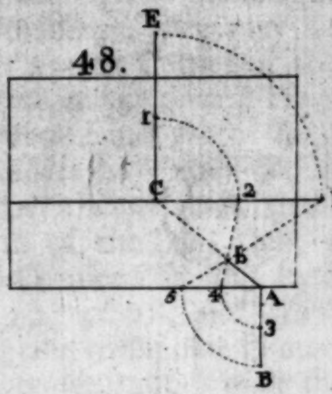
44.



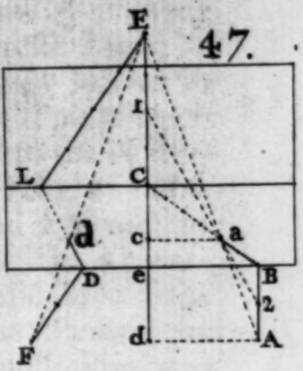
49.



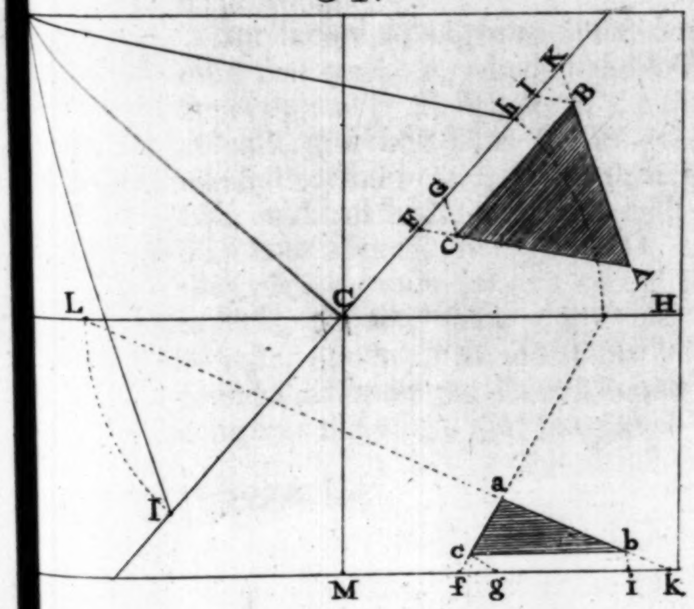
48.



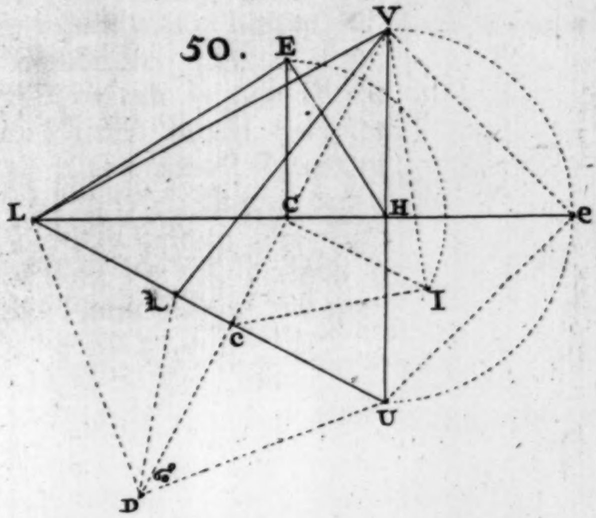
47.



51.



50.



BRITISH
1 JY64
MUSEUM

Moulding, which will form ſeveral Rectangles, and thereby divide the Planes 1 2 3 4, 5 6 7 8, into a Sort of Net-Work; then, by putting theſe Planes into Perſpective (as in the Figure) we ſhall have ſufficient Guides for drawing all the Mouldings. But to be more particular in the Operation.---Make AD equal to AB, and cut off AE equal to AD; from whence the Plinth may be compleated.---In like Manner, for the Die.---Draw the Diagonals upon the Top of the Plinth, and any where upon the Edge h g, ſet off the Projection of the Plinth, as 1.9; then draw one Line from 1 to C, and another Line from 9 to L, which will give the Projection 1 2; then, if you draw a Line through 2 parallel to h g, it will cut the Diagonals a h, b g, and give the Corners of the Front Side; and if you draw a Line from b to C, it will cut the Diagonal d c, and give the further Corners; therefore, by drawing Perpendiculars from a, b, c, we ſhall have all the Edges of the Die which can appear in this Situation.---As to the Height of the Die, or the Height of the ſeveral Mouldings, they may be found by drawing a Perpendicular from the neareſt Corner of the Repreſentation, as BH, and transferring thereon the ſeveral Heights from IK, as in the Figure; then by drawing Lines from the ſeveral Points upon B H (which meaſures the Height of each Moulding) to the vaniſhing Point of the Diagonal a h, we ſhall have thoſe Heights transferred unto the Edge a m of the Die; thus, a i and k m are the Heights of the Baſe and Cornice; ſo that by finding the Appearance of the Planes 1 2 3 4, 5 6 7 8, and drawing the Mouldings therein, and by drawing the triangular Planes at the Corners, we may finiſh the whole Repreſentation with the utmoſt Eaſe and Expedition.

But before we begin to draw out any Object in Perſpective, we muſt firſt conſider, whether the Whole, or only a Part of it, is to appear; and muſt ſketch out the Size we intend it ſhall be of, or, at leaſt, give one Line for its greateſt Dimenſion. Thus, if the whole Pedeſtal is to appear, then give AB, which is neareſt the Eye, and call it the utmoſt Length of the Plinth: But if only the Top is to appear, then give HO, and call it the utmoſt Extent of the Cornice; then, by cutting off O r equal to OM, that is, equal to OH, we ſhall have the Depth O r of the Cornice, *&c.* from whence, and with the Aſſiſtance of the Plane 5 6 7 8, (which is found exactly in the ſame Manner as the Plane 1 2 3 4) we may compleat the whole that is wanted.

Now, in order to do all this, it is neceſſary that the Artiſt ſhould (as was obſerved before) be able to apply the preceding Rules with the greateſt Readineſs; particularly That which teaches how to cut off one Line equal to another Line given.

2. *When both Sides are oblique with the Picture.*

Fig. 53. In this Figure, let A be the neareſt Corner of the Plinth, AC, AB, the Length of two Sides AG, AF, and Ak the Height of the whole Pedeſtal properly divided; (that is, like BH in the laſt Figure.)---Cut off AF, AG, equal to AB, AC, and draw the Plinth and the Diagonals upon the upper Square; then draw 1 b parallel to AB, and make it equal to the Projection of the Plinth; then cut off 1 c equal to 1 b, and from c draw Lines to H, and from 1 draw a Line to C, (the vaniſhing Point of the Diagonal 1 2) which cutting each other in 2, will give the Edge 2 7; and by drawing Lines from 2 to their proper vaniſhing Points L and H, they will cut the Diagonal kg, and thereby give the other Corners of the Die, as in the Figure.----For the Height of the Mouldings; draw Lines from 4 and 5 to C, which will cut 2 7 in the Points required; by which means the triangular Planes aik, fbg, &c. may be found, and from thence the Mouldings may be compleated.

Here alſo, if we want only the upper Part, we may begin at the Point 8, making 8E, 8D, each equal to the Length of the Cap, &c. then by finding the Plane 5678, as in the former Caſe, we ſhall have ſufficient Guides for compleating the Figure.

Here let us obſerve, that when the Pedeſtal has one Side parallel to the Picture, then the Plane 1234, (Fig. 52) which is a Guide for the Moulding, may be begun any where upon the Edge ab: But when it is oblique with the Picture, then we muſt begin from the neareſt Corner, as a; and by attending to the Figures, we may conceive, that in the firſt Caſe, the Mouldings in the Directing Plane, are like the Ends of Mouldings cut off ſquare; but in the latter Caſe, they are like Mouldings cut off at what is called the Mitre Joint. And from hence we may alſo obſerve, that all the Difficulty in putting Mouldings into Perſpective, lies in finding the little Planes 1234, &c. and therefore the Reader ſhould conſider them attentively before he proceeds any farther.

II. *Of* CIRCULAR MOULDINGS, *&c.*

The Method for determining the Appearance of Circular Mouldings, is much the ſame as that for finding the Repreſentation of ſtraight Mouldings, *viz.* by imagining a Plane to paſs through the Mouldings in a perpendicular Manner, and then putting that Plane into Perſpective: As in the two laſt Figures.

1. *To put a* TUSCAN BASE *into Perſpective.*

Give one Line for the Width of the Plinth, and draw out the proper Projection of the Mouldings, and the Plane ABCD; then cut off the oblique Side equal to the Front, and compleat the Plinth; after which draw the Diameters and the Diagonals upon the Top of the Plinth, as in the Figure, and then draw the Repreſentation of a Circle for the Seat of the lower Torus. Again, for the Bottom of the Shaft of the Column; from the Center H of the Column, draw the Perpendicular HL, and from a, where the Diameter a e cuts the Plinth, draw a d parallel to H; then make a d equal to the Height of the Mouldings AD, and from d draw a Line to C, which will cut HL in I; then will I be the Center of the Square for the Bottom of the Column: Therefore, upon the upper Edge of the Plinth, and from the Point a, make a 1 equal to the whole Projection of the Mouldings; then cut off a b equal to a 1, and draw b c parallel to a d, which will give the little Plane for the Mouldings; within which draw the Mouldings; and then we ſhall perceive that c is the Middle of the neareſt Edge of the upper Square: Therefore, through c draw a Line EF parallel to the Edge B 1 of the Plinth; then from H draw a Line through the Center 1, cutting EF in E, and then is cE half the Width of the Square: Therefore make cF equal to cE, and from thence compleat the Square, and within it draw the Repreſentation of the Circle, as in the Figure: Finally, from the Extremity of each Circle draw the two oblique Lines 2, 3, which together with the little Plane for the Mouldings, *&c.* will be ſufficient Guides for compleating the whole Baſe, as was propoſed; which is evident by inſpecting the Figures 57 and 59. Fig. 54.

As for making Columns, *&c.* of any given Proportion, or at any Diſtance, the Rule for cutting of a Line in any given Proportion, in the 43d Figure, is ſufficient for that Purpoſe.

2. *To put a* TUSCAN CAPITAL *into Perſpective.*

Fig. 55. Let K be the Center of the Square for the Bottom of the Capital.---Through K draw a Line AB parallel to the horizontal Line at pleaſure, and from f and e of the Baſe, draw Lines parallel to the Axis HI of the Column, cutting the above Line in E and F; then is EF the Diameter of the Column: Therefore diminiſh it in its proper Proportion, as 34; then is 34 the Diameter of the Neck of the Column: Therefore with the Line 34 draw the Appearance of a Square, and in that Square draw the Repreſentation of a Circle as before directed; ſo ſhall we have a Guide for the under Part of the Capital. Again, make KI equal to KF, (that is, equal to half the Diameter of the Column) and through I draw GH parallel to AB, then make IG, IH, each equal to KA, or KB, (that is, equal to half the Diameter of the Top of the Abacus) and then with the Line GH draw the Appearance of another Square, which will repreſent the Top of the Abacus: Finally, from C draw a Line through I, cutting the Edge 56 in a, and from a, ſet off a 1 for the Projection of the Capital, and draw the little Plane abcd for the Mouldings, as before: From whence the remaining Part of the Capital may be compleated, as in the 56th and 59th Figures *.

I ſhall juſt mention a Method for finding the Point where the
Diagonal of a Square will be cut by a Circle inſcribed in that
Square; which may be of uſe in this and ſome other Caſes. It is
Fig. 54. this. Divide the Edge BG into ſeven equal Parts; then ſet one Part
from each Corner, as B 4, G 5, and draw Lines to C, which will
cut the Diagonals in the Points required. I do not ſay this is mathematically
exact, but, I preſume, it is near enough for the intended
purpoſe.

Theſe are the moſt ſimple, as well as the moſt general Methods I can think of for mix'd Mouldings; and I believe any Perſon who is but tolerably ſkilled in drawing, will find them ſufficient for his purpoſe, upon all Occaſions.

3. *To find the Repreſentation of a* CORINTHIAN CAPITAL.

Fig. 62. Let AB be the Diameter of the under Part of the Capital, and let ca be the Center, or Axis, of the Capital, properly divided for the Height of its Leaves, Volutes, and Abacus.---From the Line

---

* In this Caſe the Projection of the Capital, (according to Mr. *Gibbs*, from whoſe Book I have taken my Proportions) is one-ſixth Part of its Length, and the Projections of any other Mouldings may be determined in the ſame eaſy manner by a Scale and Compaſſes.

AB, which is given, find the Appearance of a Square, in which, draw the Diameters and Diagonals, and then the Repreſentation of the Circle; which will determine the Places for the Stalks of the great Leaves, as repreſented by the Dots: Again, through o draw bd parallel to AB, and make ob, od, each equal to half the under Part of the Abacus; with which Line bd, draw the Appearance of another Square, and divide it like the Plan 1 2 3 4, Fig. Z. of the under Part of the Abacus, and then draw the Repreſentation of it, as in the Figure: Again, through a, draw another Line parallel to bd, and make it equal to the upper Part of the Abacus; then, by finding the Repreſentation of the Square abcd, Fig. Z, we may draw the Appearance of the upper Part of the Abacus, and from thence compleat the Abacus, as in the 60th Figure: Finally, find the Middle of each Face of the Abacus, as n, e, and draw Lines n, 1, *&c.* to the correſponding Points at the Bottom of the Capital; then find the Height of the Leaves by drawing Lines from C through the Dots in ca, 'till they cut 1 n in 2 and 3; after which draw the Baſket; then, by a nice Eye, compleat the Capital; beginning as is exemplified in the 60th Figure.---The Lines drawn from the Corners of the upper and under Square, will ſerve as Guides to prevent our giving the Leaves too much Projection. In Fig. 61, the Capital is compleated, and the Figures X and Z are added to explain the Thing more fully; one of which is the Plan, and the other half the Profile of a Capital.

Here it is neceſſary to take Notice, that upon Account of bringing the Diſtance of the Picture within the Compaſs of each Plate, and to make the Figures as large as poſſible, ſome of them have not that agreeable Shape which could be wiſhed; but if the Reader will chooſe a greater Diſtance, and follow theſe Rules, he will find every Objection of this kind, that may ariſe, immediately vaniſh.

III. *Of* COLUMNS *parallel and oblique with the Eye.*

1. *Let it be required to find the Appearance of two Columns in Front, and let* ab *be the Diameter of the under Part of the Plinth, and* c *the Center of the Column.* Fig. 63.

Continue ab at pleaſure, and any where upon it, as at A, draw a Line AB perpendicular to Ab; upon which Line ſet the ſeveral Heights for the Baſe, Capital, Entablature, *&c.* then from c, the Center of the Column, draw a Line cd parallel to AB, and from the ſeveral Diviſions upon AB, draw Lines parallel to the horizontal Line, which will cut cd, and give the Heights of the Baſe, Capital, and Entablature. Now, having got the ſeveral Heights, we are to conſider cd as the Axis of the Column, (that is, a Line which paſſes through the Middle of it) and then at every Dot make a Square, equal to the Diameter of that Part of the Column, *&c.* which that Dot ſtands for: Thus ab is the under Part of the Plinth, and by means of H, and the Diagonal 1 2, we may compleat the firſt Square. So alſo, r is the Square for the Bottom of the Shaft, p for where the Column begins to diminiſh, t for the Top of the Shaft, and o for the Top of the Abacus; and therefore, having got theſe ſeveral Squares, we ſhall have ſufficient Guides for compleating a Column of any Order. Again, for the other parallel Column e x.----From c to e, and upon the Line AB continued, ſet off the Diſtance which the Center of one Column is from the other, and draw e x; upon which, ſet off the ſeveral Heights, as before, from the Line AB, and then find the ſeveral Squares, as before directed.

2. *For oblique Columns.*

Upon Ab continued, ſet off the Diſtance which the Centers of thoſe Columns are from the Corner Column, and draw a Line from e to C; then cut off em, en, equal to ef, eg, and from the oblique Sides of the Square e, draw Lines to C; from whence the other Squares m and n may be compleated, as before.---For their Heights.--Draw mo and nq, parallel to ex, and from x draw xC, which will give their ſeveral Heights.

Now, if we would put an Entablature over the Columns; then the Height of the Architrave, Freeze, and Cornice, may be drawn from their reſpective Diviſions, upon the Line AB, and the Appearance of the Mouldings peculiar to each Part, may be found by the Rules already laid down for that Purpoſe. Or, they may be found thus.--Let agbf, in the Figure Z, repreſent the upper Part of the Capital x belonging to the corner Column; and we want to find the Corner of its Entablature; that is, the Corner of the lower Facia, or Freeze:--Set off the Projection of the Capital from n to e, and draw a Line to C, which will cut the Diagonal ab, and give the Corner of the Facia; ſo that by drawing the Line l from the Dot in the Diagonal, we ſhall have the Corner propoſed. In like Manner the Projection of the Cornice may be found. Continue 7 o (which meaſures its Height) at pleaſure, and make o h equal to the real Projection of the Cornice; then through h draw a Line from C, and from H draw a Line through o, and where it cuts C h continued in i, will be the Corner of the Cornice, *&c.*

From hence then it is evident, that any Number of Columns may be drawn with the greateſt Eaſe and Expedition, let their Situations be what they will; and from hence alſo we may obſerve, that any Part of a Column may be immediately produced upon the Picture in the very Place in which it is intended, without drawing out the Whole, or any other Part than that which is really to appear.

Here it may not be improper to take Notice of what we have obſerved in Chap. VI. Book I. concerning the Repreſentations of parallel Columns, which, we obſerved, would grow bigger and bigger the further they are removed from the Center of the Picture; and to point out a Method to be practiſed by thoſe who are ſatisfied with the Reaſons upon that Head; and by that Means, to give all the Columns an agreeable Shape. It is this:——Firſt find the Repreſentation of that Column which is neareſt the Center of the Picture, as ex; then ſet off the Diſtance for the Centers of the other Columns, and draw the Squares for the Plinth, Capital, *&c.* and then, upon each Side of the Axis, ſet off at the Bottom of each Column half the Diameter of the corner Column, and at the Top of the Column ſet off half the Width of the Neck of the corner Column: Finally, draw Lines from thence, ſo as to diminiſh the Column in a proper Manner, and thereby we may make all the Columns that are parallel to the Eye of the ſame Bigneſs. As to the great Projection of their ſeveral Baſes, they will not look at all prepoſterous, if they are done by any one who has but a tolerable Eye for Drawing, and is careful in taking a proper Diſtance for the Eye.

Fig. 63.

IV. *Of* STAIRS *parallel and oblique.*

1. *For* PARALLEL STAIRS.

Let AB be the Length of one Step, B1 its Height, B4 its Depth, C the Center of the Picture, and CH the Diſtance of the Picture.——Find the firſt Step by the Height B 1, and its Depth by B 4; then make 4 O equal to 4 B, and 1 D equal to 1 B; by which means the upper Step may be found. Now, by continuing BO, and BD, and dividing them properly, any Number of Stairs may be determined. Or, if only thoſe above the Eye are to be ſeen, then

Fig. 64.

then begin with the Line a b c, and proceed in the aforeſaid Manner.

2. *For* OBLIQUE STAIRS.

Fig. 65. Let AB be the Length, BO the Depth of two Steps, BD the Height of two Steps, and C the Center of the Picture.---By means of the Point HL, cut off Ba, BF, *&c.* equal to BA, BO, *&c*, then by making BD equal to the Height of the Steps, they may be compleated, as in the Figure: And after the ſame manner the Stair above the Eye is to be found.

V. *Of an* ARCH *and* PEDIMENT.

1. *For the* ARCH.

Fig. 66. Let A be the Corner of the Arch.---Set the ſeveral Diviſions for the Width and Center of the Arch upon AB, and for its Height upon the Edge A 1, and draw Lines to C; by which means the parallelogram c d e f may be found, which will be a Guide for drawing the Arch.

2. *For the* PEDIMENT.

Let abD be the Pitch of the Pediment, and CD the Diſtance of the Picture.----Find the vaniſhing Points V and L, and draw Lines from thence through the Top and Bottom of the Cornice; which will interſect each other, and give the Repreſentation of the Pediment.

VI. *Of* HOUSES *parallel and oblique.*

1. *For* PARALLEL HOUSES.

Fig. 67. Let AB, and BF, be the Length and Depth of the Houſe, BD the Height of the Walls, and C the Center of the Picture.----Draw the vaniſhing Line VL, and find the vaniſhing Points V, L of the Roof; then draw V L parallel to the horizontal Line, which will be the vaniſhing Line of that Part of the Roof which fronts the Eye. And the Roof which covers the Pediment b d e is found by drawing the perpendicular ab, and, from the Extremities thereof, Lines to C and V, which will give a Triangle a b c, whoſe Side cb is the Top of the Roof.--Or the Height of the Roof 3 4 D, may be found by continuing BE, and making DE equal to the propoſed Height.

2. *For* HOUSES *that are* OBLIQUE.

Fig. 68. In this Figure AB is the Depth, and AC the Length of the Houſe, VI is the vaniſhing Line of the End, and V, I, are the vaniſhing Points of the Roof; the vaniſhing Line of the Pediment, *&c.* is v l, and its vaniſhing Points v and l; the Length of the Roof over the Pediment is found by means of the Triangle a b c, as before.

VII. *To put the Inſide of a Room into Perſpective.*

Let ADFE be a Picture upon which the Inſide of a Room is to be drawn.---Here C is the Center of the Picture, and AB the Length of the Room.---Set off the ſeveral Diviſions from A to B, and cut off the ſeveral Spaces upon A 1 equal to thoſe upon AD; then ſet off the Height upon AE, and draw Lines to C; which will be ſufficient for our Purpoſe. Fig. 69.

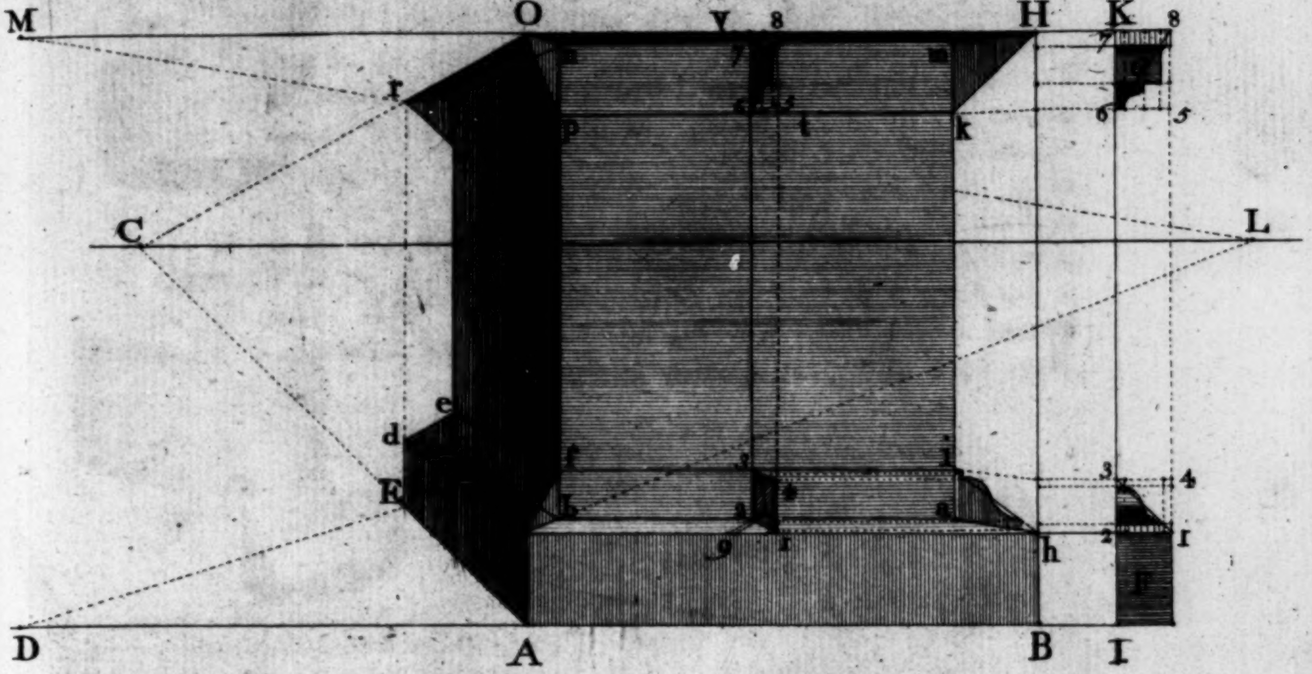
If any Repreſentation of this Kind is to be drawn upon a Wall, ſo as to make a Deception like the Continuance of a Room, Care muſt be taken to chooſe a proper Diſtance, and to make the Height of the horizontal Line exactly equal to the Height of the Eye, *viz.* about five Feet ſix Inches. If the Wall be too large for any Diſtance that can be taken within the Room, then ſome other Subject muſt be painted upon it, ſuch as will admit of its being divided into Frames, Compartments, or the like: And the ſame may be ſaid in regard to Cielings; for, in either Caſe, if the Diſtance be an improper one, all the Repreſentations will have a bad Effect.

Theſe Examples are the moſt general I can think of; and I flatter myſelf, that they will be found ſufficient to anſwer every Deſign which can be propoſed in common Practice; but if there ſhould appear any Difficulty in applying the aforeſaid Rules upon ſome extraordinary Occaſions (as when the Deſign conſiſts of many Parts, or when it happens that any of the vaniſhing Points are out of the Picture) then the beſt Way will be to draw out the whole Deſign, by Way of Model, in a ſmall Compaſs, upon Paper, and from thence, by a proper Scale, or by Net-Work, to transfer the whole unto the real Picture; for then the moſt diſtant vaniſhing Points may be very eaſily come at: Or in many Caſes, the real Picture may either be laid flat upon a Floor; or elſe have Rulers made to fix upon the back Part of the ſtraining Frame by Screws, or ſome ſuch Contrivance, whereby, and with the Aſſiſtance of ſmall Twine fixed upon Pins at each vaniſhing Point, we may produce almoſt every Repreſentation which can be deſired.

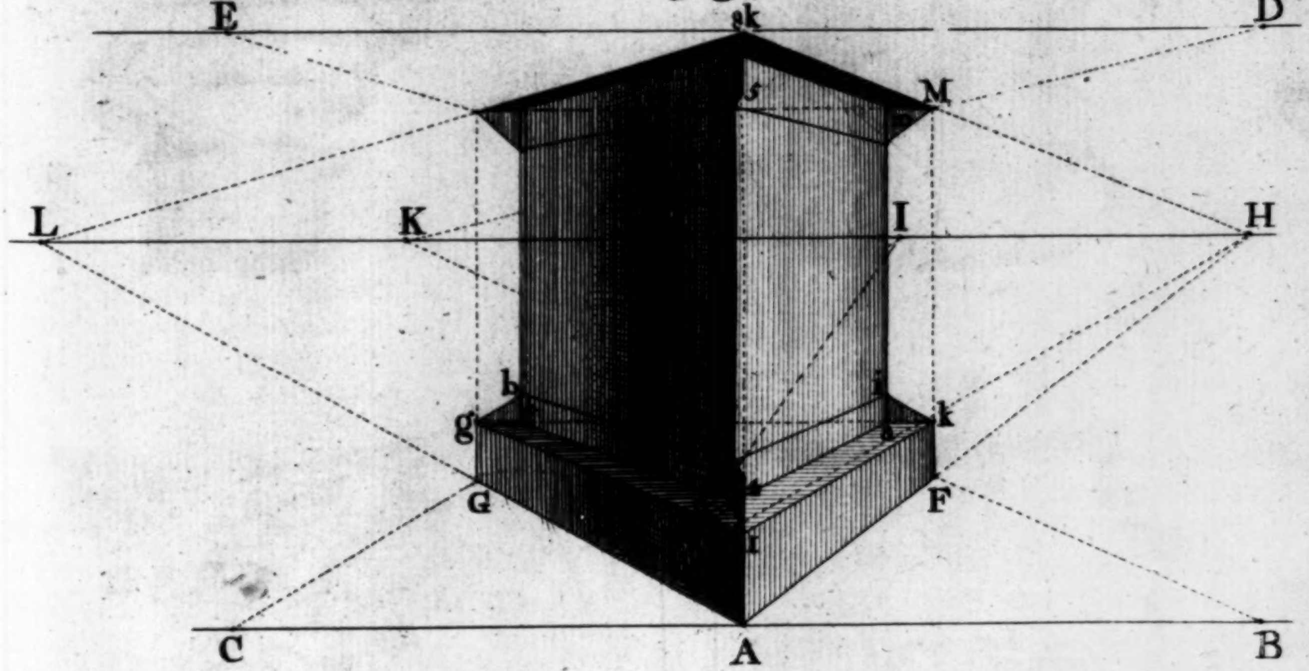
The

The three following Figures I have not only given as Examples in Perſpective, but have attempted to diſpoſe each Object in ſuch a Manner as to produce agreeable Shapes, Effect, *&c.*---The firſt repreſents a variety of Figures tending to various vaniſhing Points in the horizontal Line, below the horizontal Line and above it; amongſt which, are the five regular Solids; and the whole together, contains all the Rules and Principles of Perſpective. The next Figure is a View of *Framlingham* Caſtle in *Suffolk*, a Place of great Antiquity, and formerly the Seat of the *Howards*, *Mowbrays*, *&c.* which is produced in this Place as an Example of a Building that tends to ſeveral vaniſhing Points upon the horizontal Line only: And the laſt Figure is an Example of a Landſkip, by a very great Genius in that Way.

52.

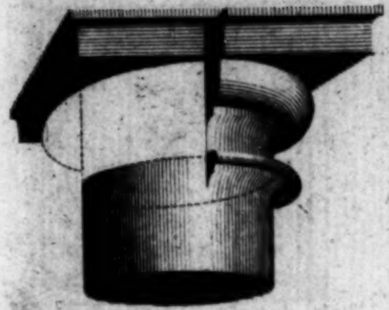

M
O
V
8
H
K
8
7
r
n
m
c
p
t
k
6
5
C
L
e
d
f
i
3
4
E
b
a
a
h
2
1
9
F
D
A
B
I

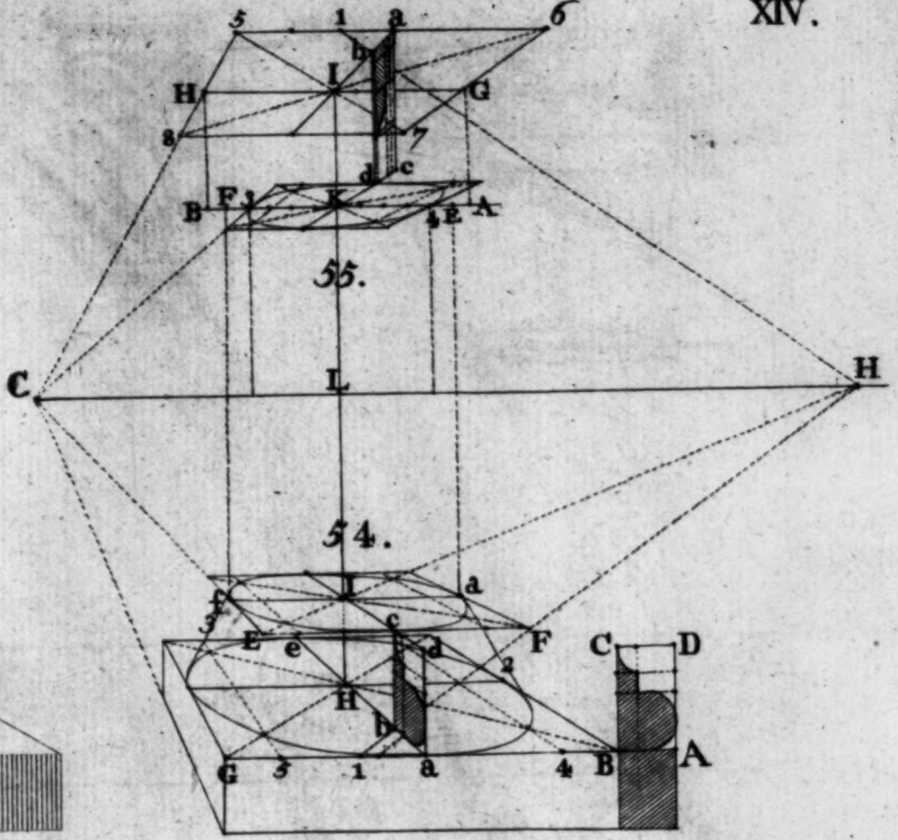
53.


E
8k
D
M
5
L
K
I
H
b
i
g
k
a
G
F
1
C
A
B

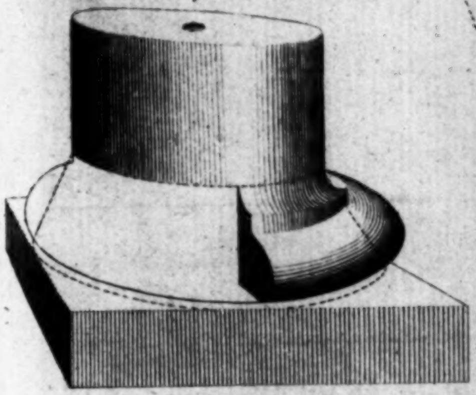
BRITISH
1 JY64
MUSEUM

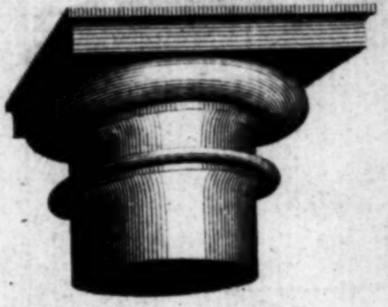
56



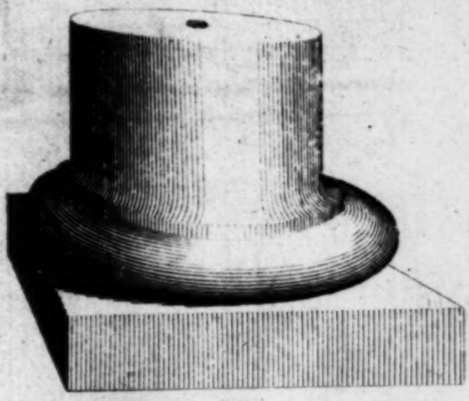


57

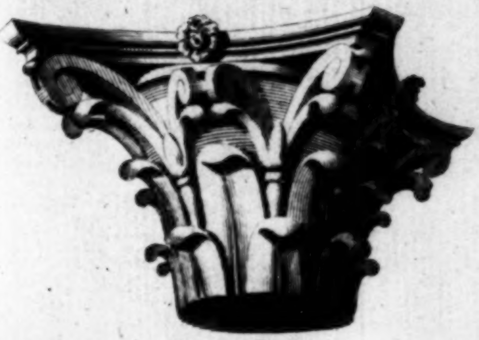




59

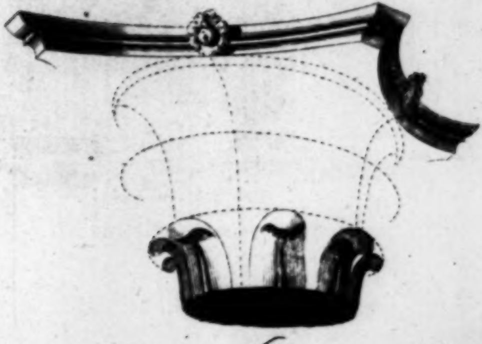


59



E Rooker sc.

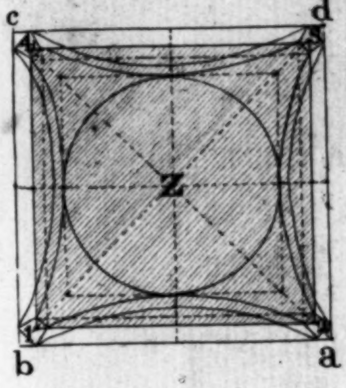
61



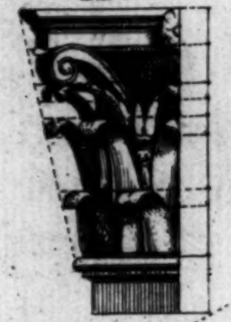
60

BRITISH
1 JY64
MUSEUM

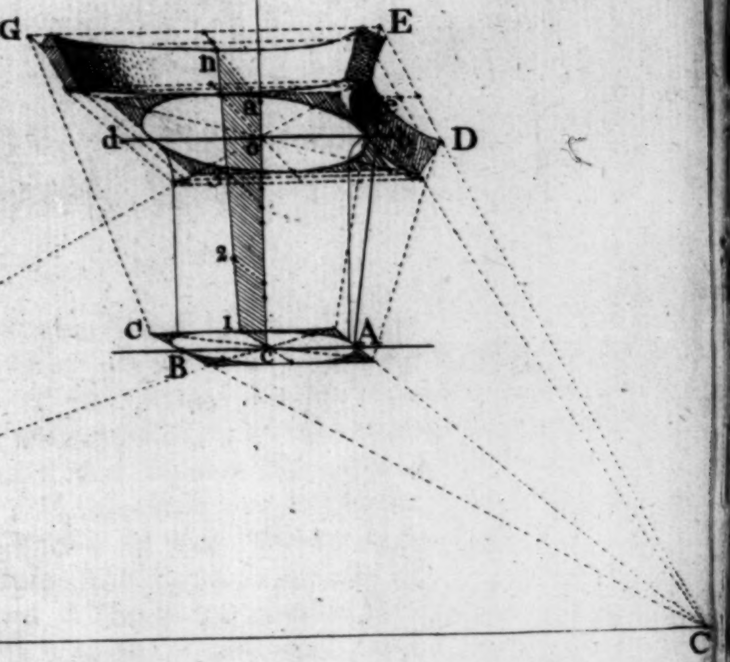
B2.


c
d
Z
b
a

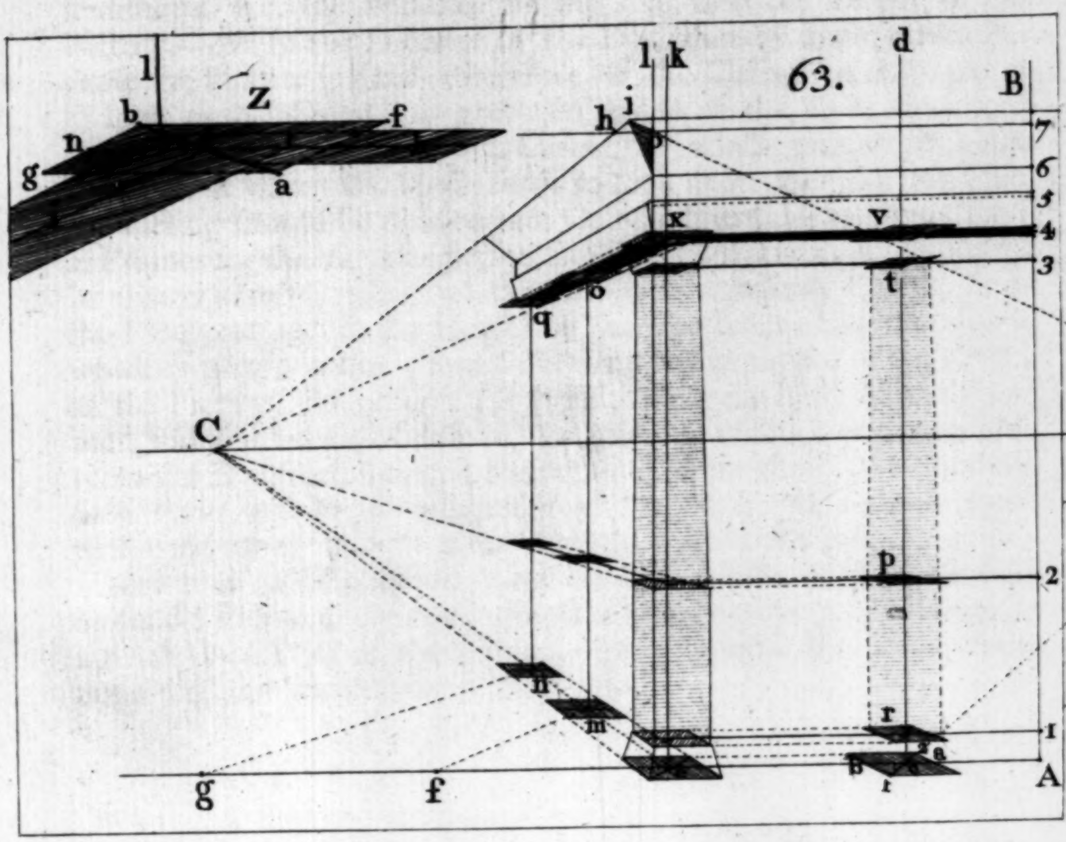
X



62.


G
E
n
a
d
o
D
3
2
C
1
A
B
c
H
C

63.


l
Z
b
f
n
g
a
l
k
d
B
i
h
7
6
5
x
v
4
3
t
q
o
C
H
2
p
n
m
r
1
g
f
A

BRITISH 1 JY64 MUSEUM

CHAP. IV.

Of the PARALLEL PICTURE, *ſuch as Cielings, or the like, or what is uſually called,* Horizontal Perſpective.

THIS Kind of Perſpective is extremely eaſy, becauſe little more is required to be known than what has been already taught in Sect. II. Chap. II. of this Book, *viz.* How to find the Appearance of Objects which are ſuppoſed to lie upon the Ground. For moſt Objects which are drawn upon Cielings, are ſuppoſed to be perpendicular to them, and therefore, the Rules for determining the Repreſentations of Objects in this Manner, are exactly the ſame as thoſe for determining the Repreſentations of Objects which lie flat upon the Ground in the perpendicular Picture; and conſequently, the Rules which ſerve in one Caſe, will ſerve in the other alſo.

The firſt Things to be conſidered in theſe and the like Repreſentations, are, the Diſtance of the Eye, and the Center of the Picture.---As to the Diſtance of the Eye, that is unalterable, becauſe the Picture is fixed; therefore, if the Cieling be ſo large, or ſo low, as to ſubtend too great an Angle at the Eye; that is, if the longeſt Dimenſions of the Cieling be much greater than the Diſtance at which the Spectator is to look at it, then, in this Caſe, the Cieling ſhould be divided into Compartments, which may ſerve as Frames for the intended perſpective Repreſentations: And we muſt be always careful, when we take the Height of any Cieling from the Floor, to deduct the Height of the Spectator's Eye therefrom, which is uſually about 5 Feet 6 Inches. And in regard to the Center of the Picture, the general (and, I believe, the beſt) Method has been to fix it in the Middle of the Picture, unleſs any Thing prevents the Eye from ſeeing it conveniently from that Place; becauſe then there will be a Uniformity of the Parts, which will agree with each other, and be more likely to deceive the Eye.

And it is to be obſerved, that in theſe Kinds of fixed, or immoveable Pictures, the Spectator ſhould always fix his Eye directly againſt the Center of the Picture; for otherwiſe the Repreſentations will not have their deſired Effect.

Now, in order to draw any Piece of Perſpective upon a Cieling, the beſt Way ſeems to be this, *viz.* Take the Dimenſion of the Cieling, and make an exact Calculation of the Diſtance and Height of the Eye; then draw out the intended Deſign upon a large Piece of Paper, by Way of Model, and from thence transfer it unto Canvas, with the Addition of Colouring, Effect, *&c.* and finally, from thence draw it upon the Cieling, by Net-Work.

1. *To draw upon a Cieling a Deception, which, viewed from a proper Point, ſhall appear like the Sides of the Room continued upwards.*

Fig. 73. 74. Let ABFD be a Cieling drawn upon Paper to a certain Scale, and let E be the Eye, EC its Diſtance, and C the Center of the Picture. Now, let it be required to make the Cieling appear as if the Sides of the Room were continued upwards equal to the Length AB.---Through the Center of the Picture draw E1, E2, parallel to AB, which may be conſidered as the horizontal Line; then draw Lines from the Corners A, B, F, D, to the Center C, and make CE1 equal to CE; by which means Aa may be cut off equal to the given Length AB, and conſequently, from thence all the Repreſentations may be compleated, as in the Figures: Thus, ab being drawn parallel to AB, gives the Side ABab, and ad being drawn parallel to AD, compleats the Side ADad, *&c.* ---In the 73d Figure, the Center lies out of the Middle of the Picture; but in the 74th Figure, the Eye is directly in the Middle.

Here we may obſerve, that if Lines are drawn thro' the Center of the Picture parallel to the Sides of a Room, then thoſe Lines may be conſidered as ſo many horizontal Lines, and may be made uſe of accordingly. Thus, E1CE2 will ſerve as a horizontal, or vaniſhing Line, for all Objects which can lie upon the Planes ABab, DFdf; and ECE3 will ſerve as a horizontal Line for any Objects which can lie upon the Planes ADad, BFbf.----By turning the Figures we may conceive this very clearly; but in the next Figure it is more fully explained.

In this Figure I ſhall ſhew how to find the Repreſentation of ſuch Objects only as may occur in common Practice, ſuch as Columns, Pilaſters, Arches, and Windows. And firſt of Columns.

2. *To find the Appearance of* TWO CYLINDERS *upon a Cieling.*

Fig. 75. Let the Circles H, I, repreſent the Ends of two Cylinders, and let E2CE4 be the vaniſhing Line of the Plane ABab, CE3 the Diſtance, and C the Center of the Picture.-----About each Circle H, I,

H, I, deſcribe a Square, and make CE 4 equal to CE 3; then draw a Line from each Corner of the Square to C; and then, by means of the Point E 4, a Parallelopiped may be made of any Length, which will be a Guide for compleating the Cylinder; as is ſhewn in Figure 29 of this Book. Now, by the ſame Method, the Appearance of Columns may be determined, with this Difference only, that three Squares muſt be found as Guides inſtead of two; that is, one for the Bottom of the Column, another where it begins to diminiſh, and the Third at the Neck of the Column.

3. *To find the Repreſentation of* TWO PILASTERS.

Let F and G be the Ends of the Pilaſters.---From each Corner draw Lines to C, and, by means of the Point E 2, cut off each Pilaſter to its proper Length.

4. *To determine the Appearance of a* SQUARE OBJECT *which lies oblique with the Picture.*

Let 5 be one Corner, 5 7 the given Length, and E 2, E 4, the vaniſhing Points of the Sides.----From the Corner 5 draw Lines to the above vaniſhing Points, and cut off 5 6 equal to 5 7; from whence the Figure may be compleated.

On the oppoſite Side DEde, I have finiſhed theſe Repreſentations with Shadows, *&c.*

5. *To put an* ARCH *into Perſpective.*

Let KM be the Width of the Arch, Mh the Height to where the Arch ſprings, and hi the Height of the circular Part; and let E1CE3 be the vaniſhing Line, CE 2 the Diſtance of the Picture, and C its Center.---From K and M draw Lines to C, and cut off Mn, no, equal to Mk, hi; then draw the Parallelogram nopq, which will be a Guide for drawing the Arch. Again, for the Depth of the Opening---From K draw a Perpendicular to DA, and make it equal to the propoſed Depth; and from its Extremity z draw a Line to C; then from q draw a Line parallel to Kz, which will cut Cz, and thereby give the proper Depth; do the ſame on the other Side; then draw the bottom Curve for the other Side of the Arch, parallel to the upper Curve, as in the Figure; and ſo will the Repreſentation be compleated.

6. *To find the Appearance of a* WINDOW, *the Top of which we will ſuppoſe to be even with the Top of the Arch, and to be two Diameters in Height.*

Set off the real Width L f, and its Height L g, and from the Points L, f, g, draw Lines to C; then continue the Line o p to r, which will give the Top r s, and from E 1 draw a Line through the Corner t, cutting g t in w; then from w, draw w v parallel to r t, which compleats the Window r s o x. The Depth is found in the ſame Manner as the Depth of the Arch, *viz.* by the Perpendicular L.

On the oppoſite Side to this alſo, are the above Figures wholly compleated.

7. *To put a* CORNICE *into Perſpective.*

Fig. 76. Draw out the Projection, *&c.* of the Cornice, about which deſcribe the Plane ABCD; then put that Plane into Perſpective, as FGHI; from whence all the Mouldings may be determined, as in the Figure.

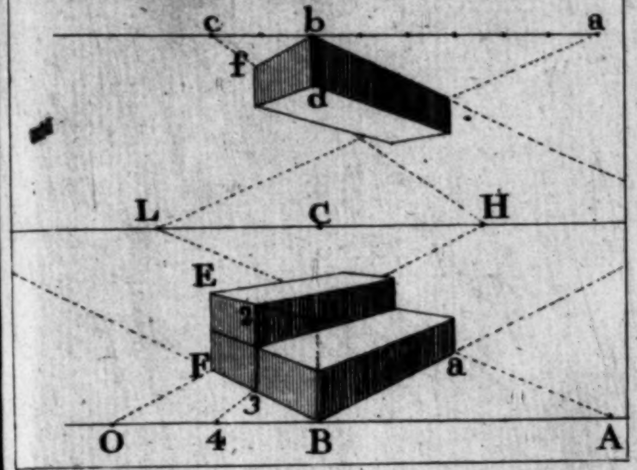
8. *To put a* BASE *and* CAPITAL *into Perſpective.*

Fig. 77. For the Baſe.-----Altho' nothing more than the Plinth can in general be ſeen by the Eye, yet I have here given a Method for determining the whole Projection.---Let AB be the Diameter of the Plinth, and BF the Height of the Baſe; make a Square with AB, and from B draw a Line to C, and cut off BD equal to BF, and from D draw DC parallel to AB, and with DC make another Square; then divide AB into eight equal Parts, and one of thoſe Parts (according to *Gibbs*) is the Projection of the Mouldings: Therefore, make B 1 equal to one of thoſe Parts, and from 1 draw a Line to C, cutting the Edge of the parallel Square in 3; then from 3 draw a Line parallel to CD, and ſet off the Diſtance 3 D upon the other three Sides of the parallel Square; then, by drawing Lines through thoſe Points, we ſhall have a Square equal to the Diameter of the Column; and from theſe two Squares the whole Appearance is to be compleated.----The Figure G repreſents it as finiſhed.

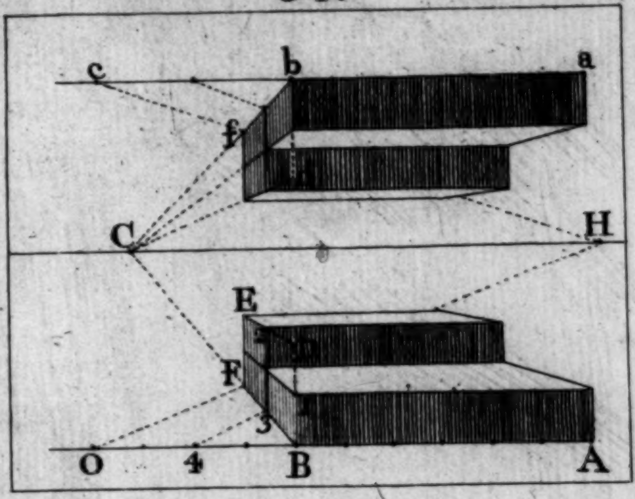
9. *To put a* CAPITAL *into Perſpective.*

Let A B be the Diameter of the Bottom of the Capital, 1 2 the Diameter of the Abacus, 1 3 the Height of the Capital, and B 2 the Projection of the Capital.---Set off B 6 equal to B 2, and make the

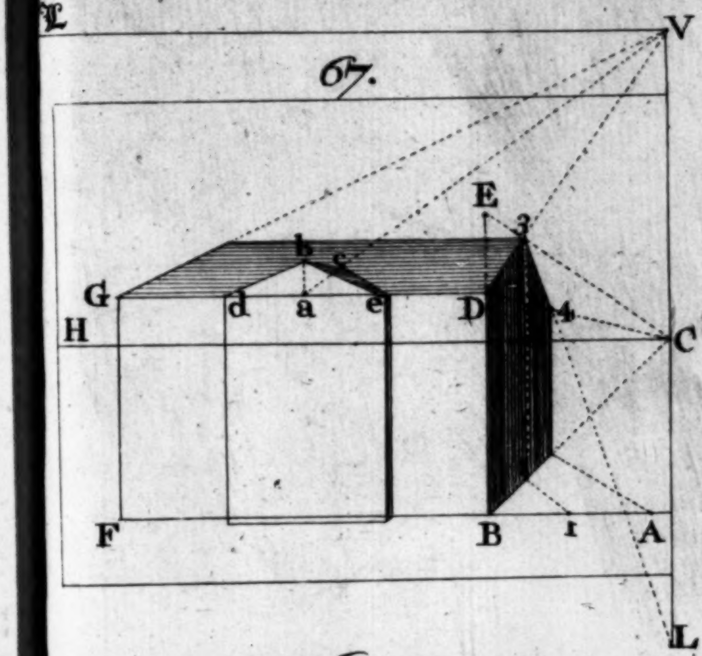
65.



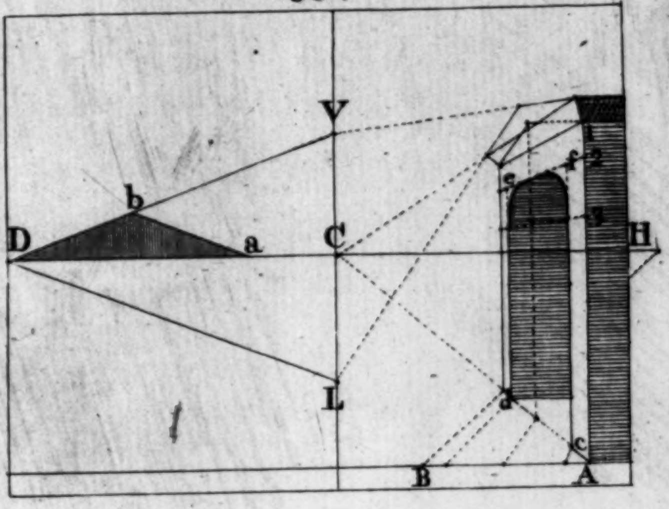
64.



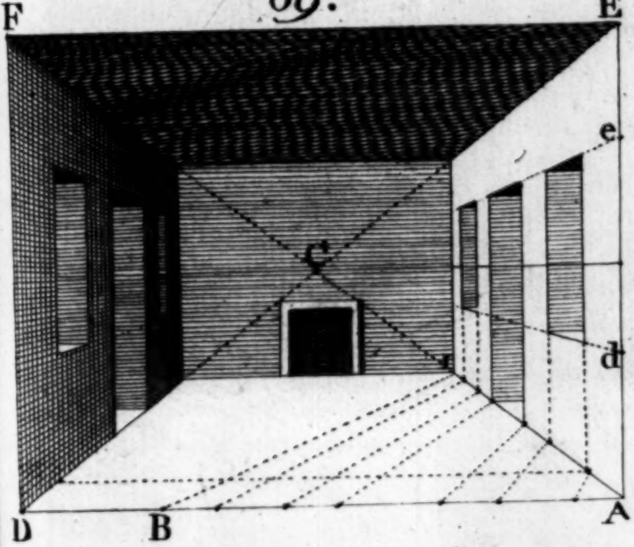
67.



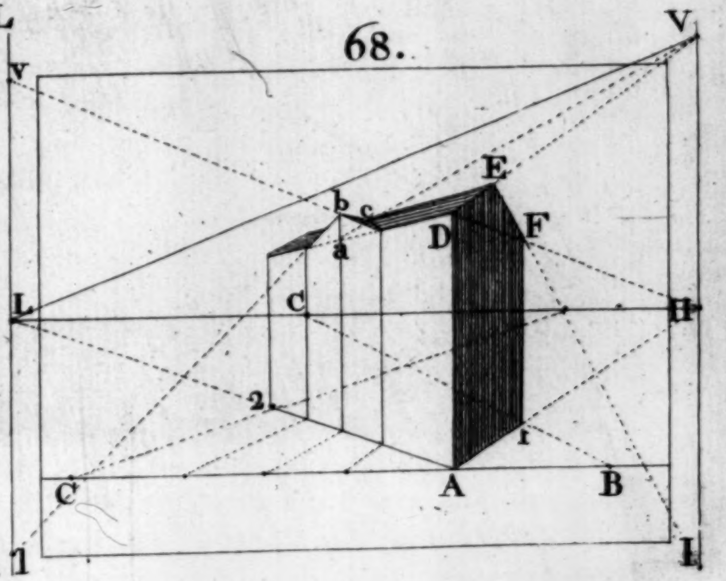
66.



69.



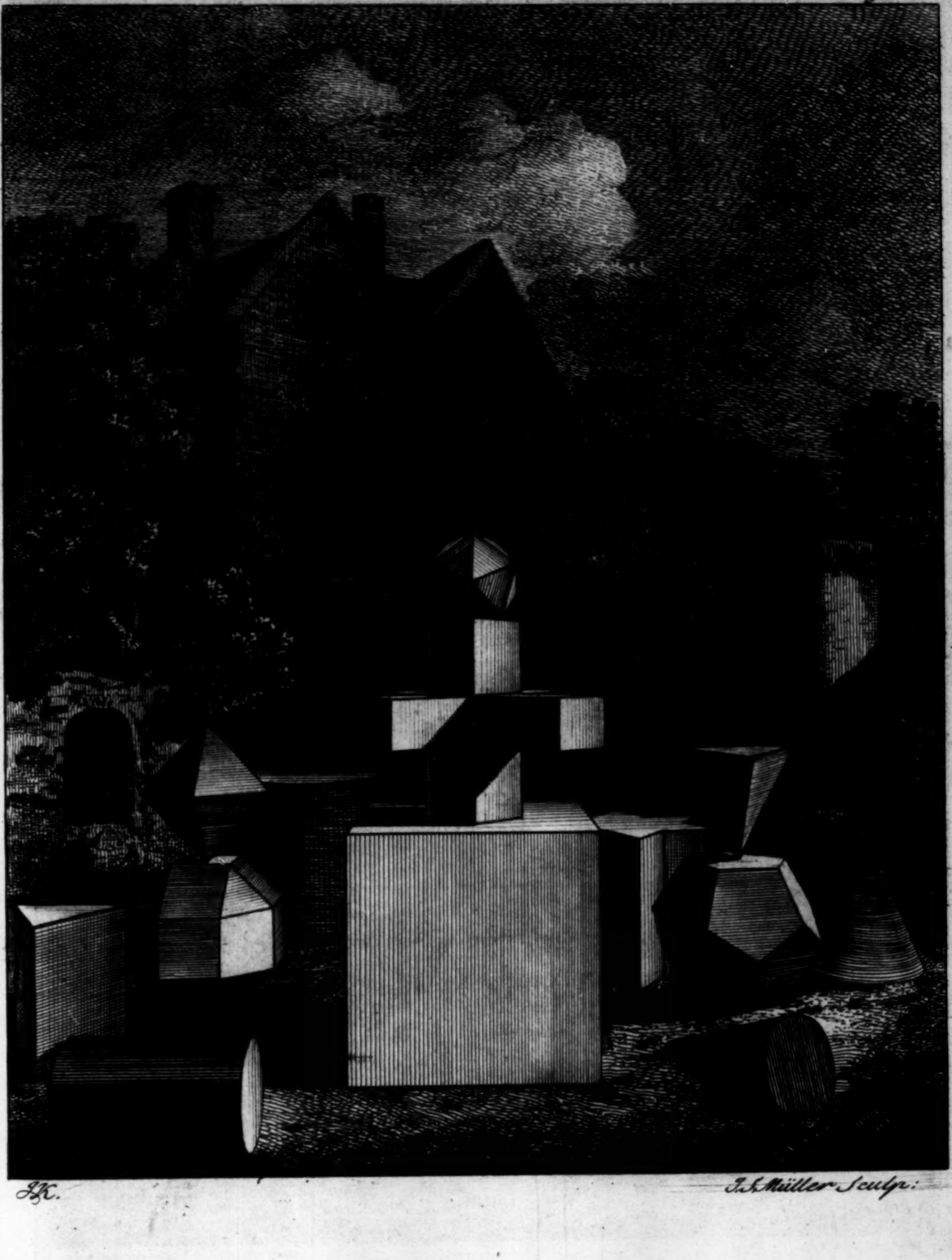
68.



BRITISH
1 JY64
MUSEUM

XVII

B. 2. Fig. 10.

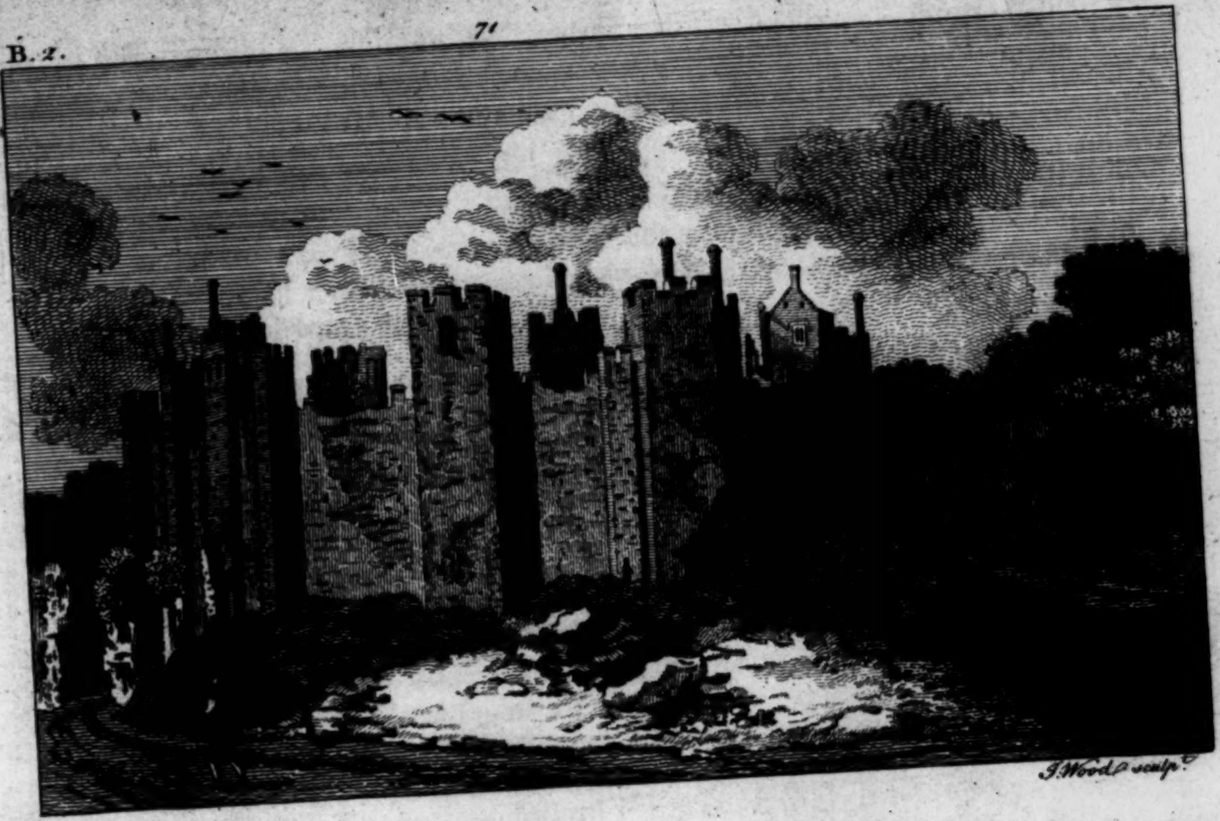


J. K. J. J. Müller Sculp:

BRITISH 1 JY64 MUSEUM

B. 2. XVIII.

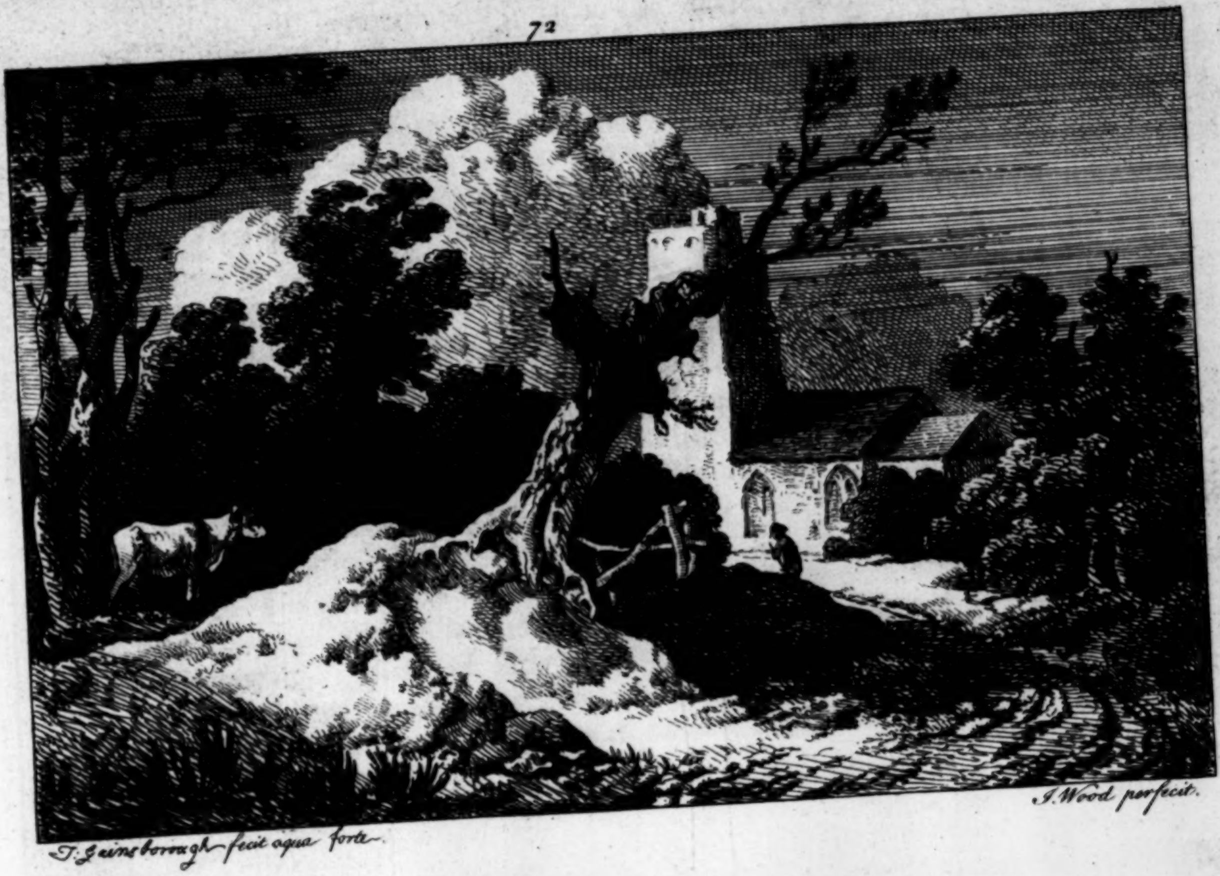
71



J. Wood sculp^t

JK: delin.

72



J. Wood perfecit.

T. Gainsborough fecit aqua forte

BRITISH
1 JY64
MUSEUM

the Square a b c d; then draw 1C, 2C, and cut off 1D equal to 1 3, then draw DF parallel to AB, and with DF make a Square; finally, from the Corner of one Square draw Lines to the correſponding Corners of the other, as in K; then ſhall we have ſufficient Guides for compleating the Capital.

10. *To put the* HUMAN FIGURE *into Perſpective.*

Having made a Deſign of the Figure, deſcribe the Frame about it, as ABCD, and then reticulate it in a proper Manner; after which, put that Frame and the Reticulation into Perſpective, as a b c d, which will give all the Foreſhortnings, as in the Figure. Fig. 77.

I am very ſenſible, that 'tis impoſſible to give Rules for putting the Human Figure correctly into Perſpective, and that the greateſt Part muſt be left to the Judgment of the Artiſt; yet the above Hint may be of ſome Service in deſigning Figures for the above Purpoſes. So likewiſe, as to the Size of Figures which are to be ſeen at a conſiderable Diſtance; I know of no Rules by which they can be correctly determined; and therefore, in ſuch Caſes, the beſt Way is, to ſketch out ſeveral Figures of different Sizes upon the intended Picture, then, by ſurveying them from the Point of View, the Eye will immediately inform the Artiſt which is of a proper Proportion.

In Book I. Chap. IV. Sect. 3, we have given ſome general Rules from Mr. *Hamilton*, for drawing any Perſpective Repreſentations upon vaulted Roofs, Domes, or other uneven Surfaces; and therefore, if the curious Reader would inform himſelf of that Kind of Perſpective, he muſt refer to thoſe Figures, where this Article is conſidered at large; which will ſufficiently explain the 78th and 79th Figures, ſince they are thoſe Rules applied to Practice. But as I have ſaid very little upon drawing a Dome, *&c.* upon a flat Cieling, and as the Operation is quite Mechanical, I ſhall therefore introduce it in this Place.

In order to find the Repreſentation of Domes, *&c.* it is neceſſary to draw out the Plan, and half the Elevation, of the Deſign which we intend to repreſent, to a proper Scale, upon Paper: Thus, let the 80th Figure be the Section, or half the Elevation, of the intended Deſign; and let the two outward Circles,* and the ſmall *Fig. 81. Squares and Circles within them, repreſent the Plan of it: From which two Figures we may perceive, that the Deſign conſiſts of eight Columns upon Pedeſtals, with an Entablature, in the Corinthian Order; that thoſe Columns are ſuppoſed to ſtand againſt a pera perpendicular Wall Ae, Fig. 80; and that the Dome is a Semicircle, and begins to ſpring from the Top of the Cornice. Now, having drawn out the Plan and Elevation, as above directed, the Repreſentation of any Deſign may very eaſily be determined in the following Manner.

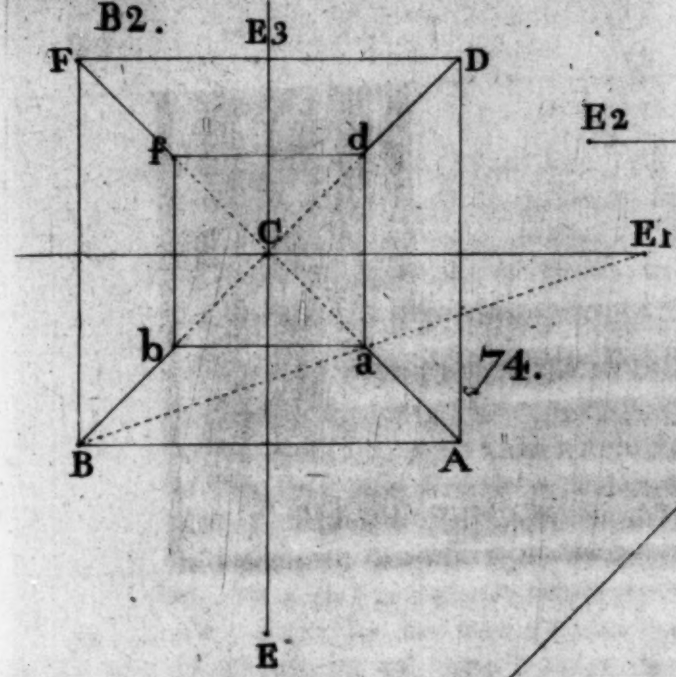
11. *To draw upon a flat Cieling the Repreſentation of a* DOME[*].

Having given the Elevation and Plan, chooſe the Center and Diſtance of the Picture. Thus EC, Fig. 81, is the Diſtance of the Picture, and C is its Center; that is, EC is the Diſtance at which the Eye is to view the Dome when painted, and directly under C is the Point from whence the Eye ſhould be placed to look at the Picture. Now, this Point C being taken out of the Picture, will give a greater Length for the Columns, *&c.* and will prevent ſome Confuſion, which would be occaſioned by placing the Center within the Picture. Theſe neceſſary Points being ſettled, let us next deſcribe the Parallelogram ABCD about the Elevation, Fig. 80, and then draw Lines parallel to AD, from the ſeveral Heights g, f, e, *&c.* as in the Figure: After which, from the Center of the Picture C, (Fig. 81) draw CD perpendicular to EC, and from E draw EA, parallel to CD; then from A draw AD parallel to EC, and continue it beyond D at pleaſure; and then will EA be a Line for the Plan, and AB a Line for the Elevations: Therefore, from the Point A ſet off the ſeveral Meaſures from AD, Fig. 80, which are the Meaſures of the Plan; and from AE of the ſame Figure, ſet off the ſeveral Diſtances, which are the ſeveral Meaſures for the Elevations: Thus Ad, Fig. 80, is the Width of the Plan AD, and AB the Height of the whole Deſign, properly divided for the Height of the ſeveral Members, which may eaſily be conceived by comparing the two Figures 80 and 81. Having proceeded thus far, the next Thing is to put the Elevation into Perſpective, as the 81ſt Figure; where Abcd, *&c.* is the Repreſentation of ABCD, Fig. 80. This is done by drawing Lines from A and d to the vaniſhing Point C, and then drawing other Lines from the ſeveral Diviſions upon AB; which cutting AC in correſponding Points, will give the apparent Depth of each Part;

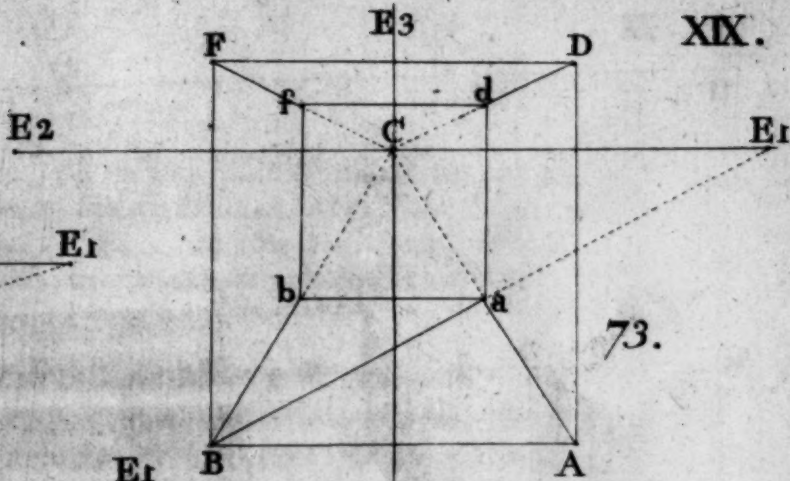
---

[*] This Method for finding the Repreſentation of a Dome upon a flat Cieling, is principally taken from *Andrea Pozzo*'s Firſt Book upon Perſpective, publiſhed by Mr. *John Sturt*, Engraver, in 1707; and therefore, if what I am going to advance upon the Subject ſhould appear not to be ſufficiently clear, the Reader is referred to the above Book.

XIX.

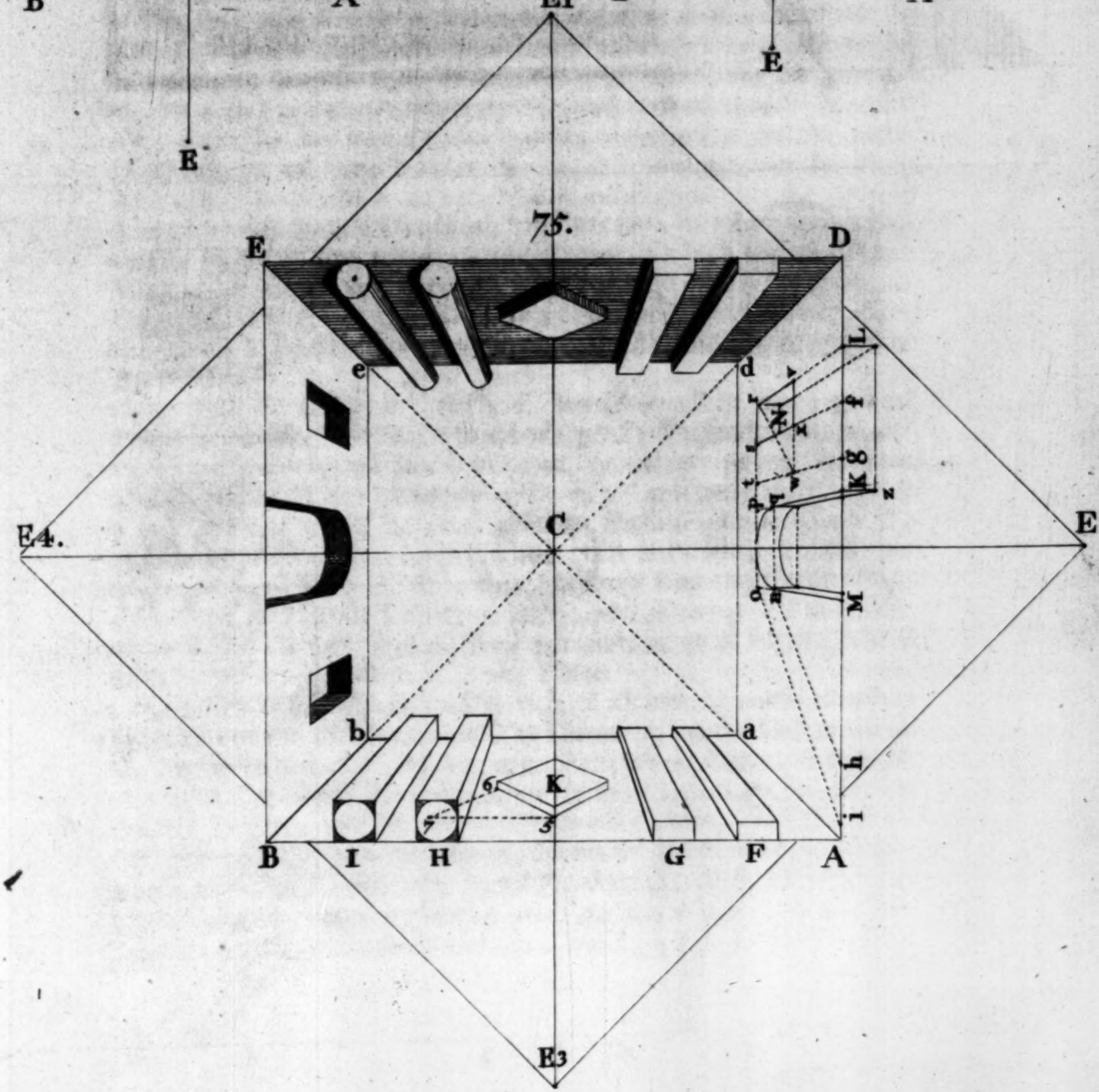

B2.
E3
F
D
f
d
C
E1
b
a
B
A
E

74.

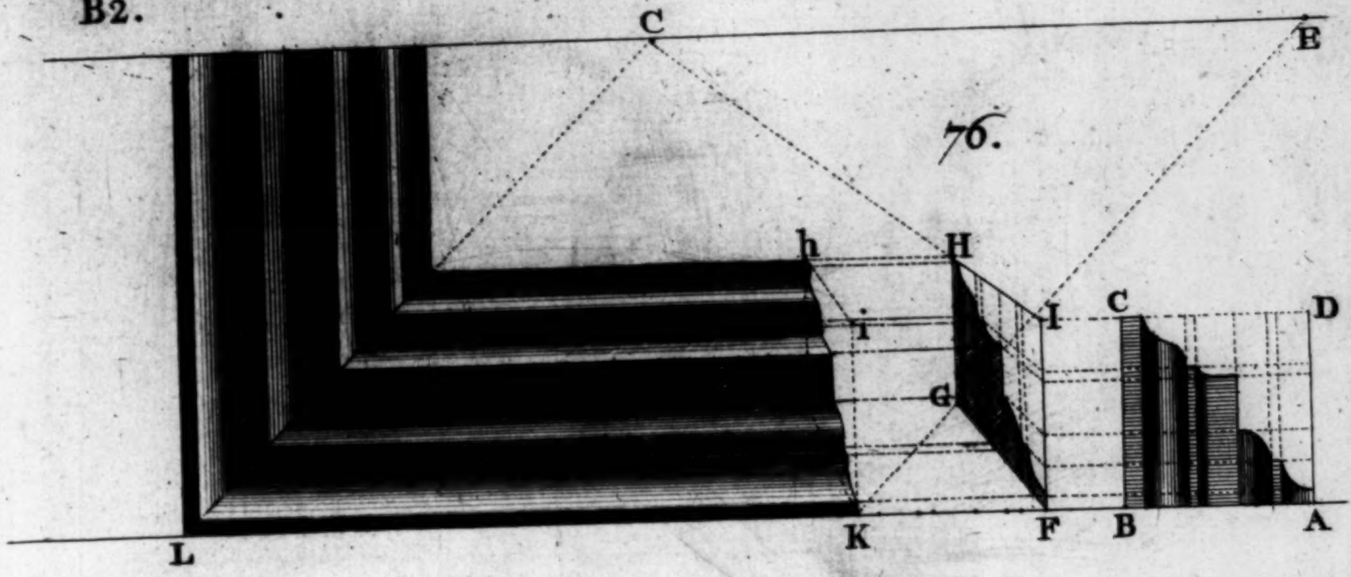

F
E3
D
f
d
E2
C
E1
b
a
B
A

73.

75.

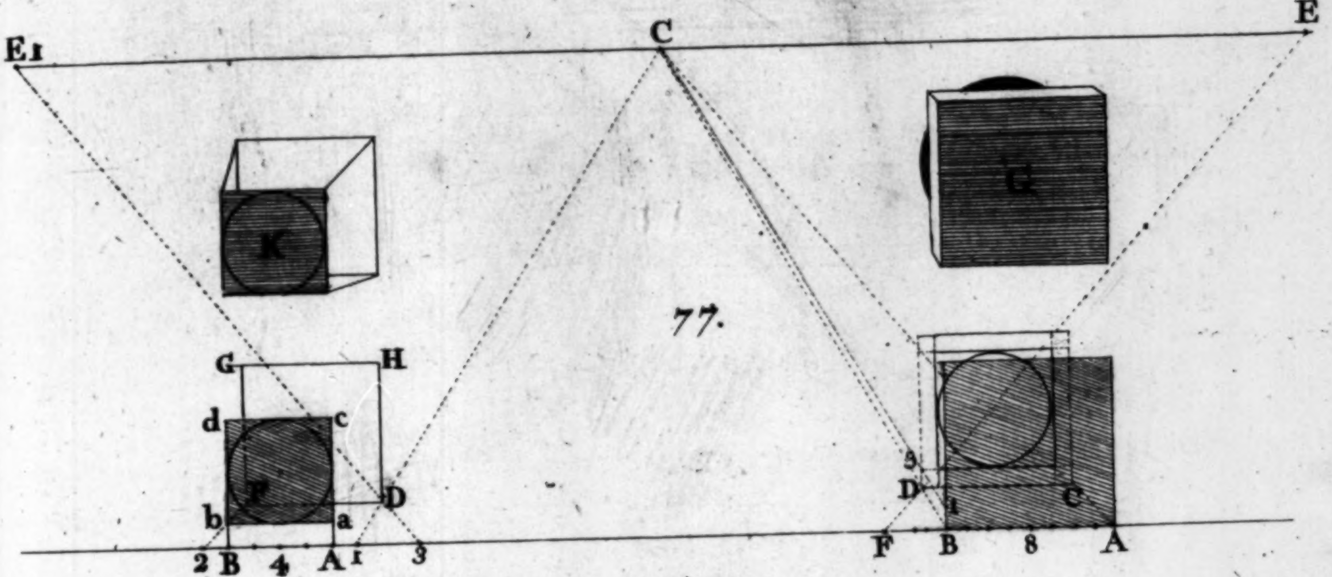

E1
E
D
L
e
d
r
v
N
f
s
x
p
t
K &
w
z
q
C
E4.
E2
o
n
M
b
a
h
K
6
7
5
i
B
I
H
G
F
A
E3

BRITISH
1 JY64
MUSEUM



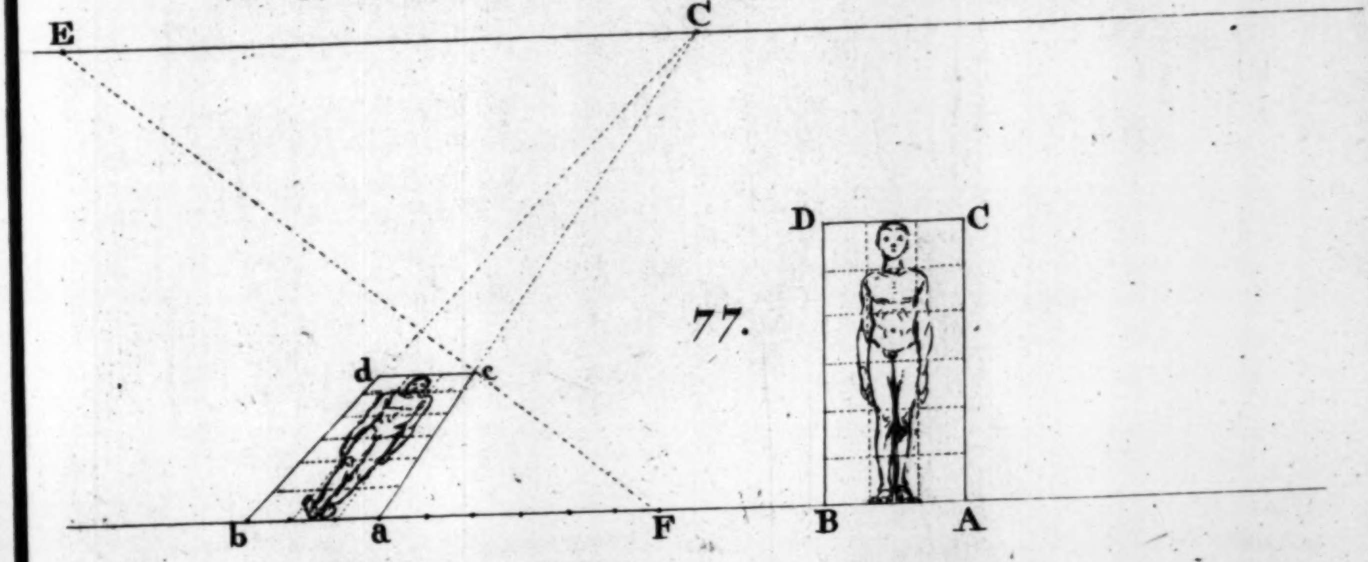
76.

C
E
h
H
i
I
C
D
G
K
F
B
A
L



77.

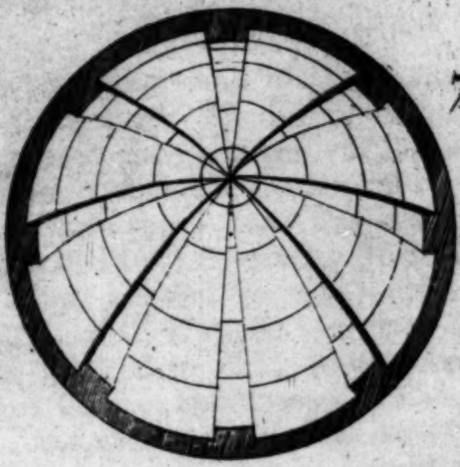
E1
C
E
K
G
G
H
d
c
F
D
b
a
2
B
4
A
1
3
5
D
4
C
F
B
8
A



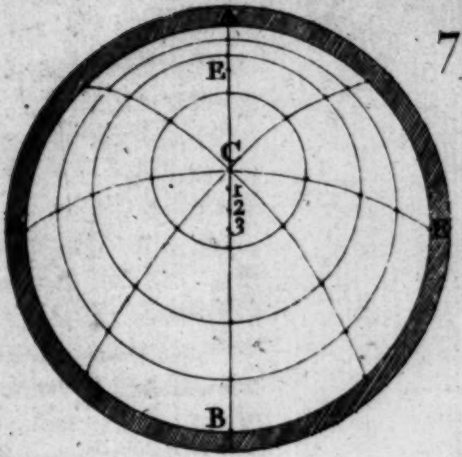
77.

E
C
D
C
d
c
b
a
F
B
A

BRITISH
1 JY64
MUSEUM

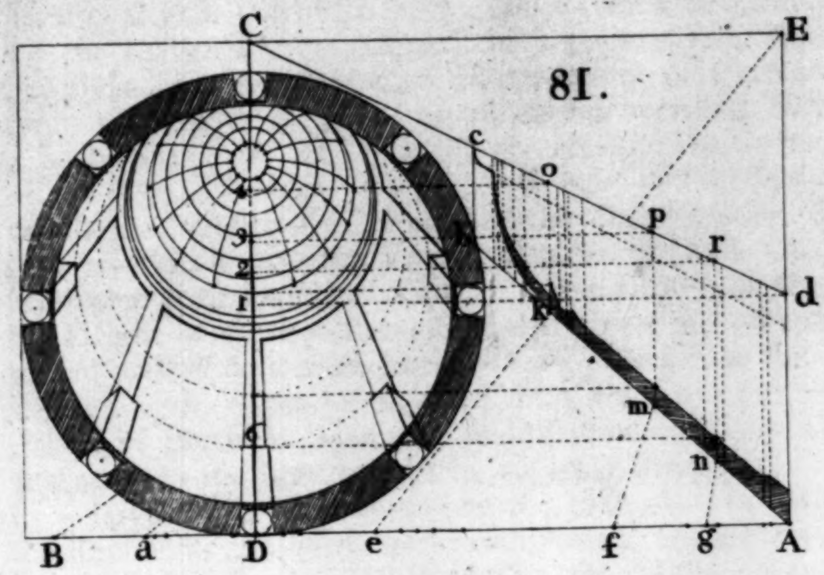


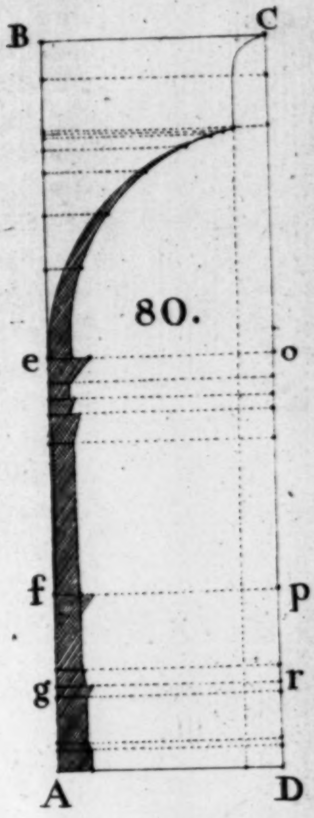
79.



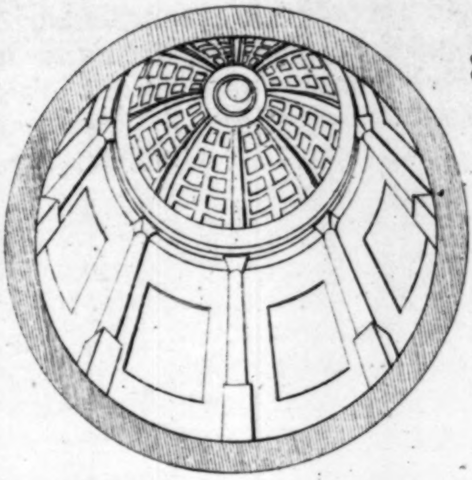
78.

81.





80.



82.

BRITISH 1 JY64 MUSEUM

from whence the whole Elevation may be reduced into Perſpective, as in the Figure. Having proceeded thus far, the next Thing (and indeed the Principal of all) is, to deſcribe ſeveral Circles each from a different Center, and each of a different Diameter; which is done thus: From the ſeveral Diviſions, as n, m, k, draw Lines parallel to AE, cutting dC in r, p, o; then from d, r, p, o, draw Lines parallel to AB, cutting the Perpendicular CD in 1, 2, 3, 4; then is 1 the Center of the outward Circle, and 1D (which is equal to Ad) is its Radius; therefore, deſcribe the outward Circle, and from the ſame Center deſcribe the ſecond Circle, and then, within thoſe two Circles, draw the Plan, as in the Figure. Again, for the Height of the Pedeſtal; draw 56, r2, parallel to AB, cutting CD in 2 and 6; then is 2 the Center, and 26 the Radius of that Circle which governs the Heights of the Pedeſtals. In like Manner, 3 is the Center of the Circle which limits the Length to where each Column begins to diminiſh, and 4 is the Center of the Circle for the Noſe of the Cornice; and ſo of the reſt: All which may be made very familiar by drawing out the Figure. As to the Returns of the Pedeſtals and Mouldings, they all vaniſh into the ſeveral Centers of thoſe Circles which determine their Heights: Thus, 2 is the Center of the Circle for the Height of the Pedeſtals; and therefore, the oblique Sides of thoſe Pedeſtals terminate in that Point. And as to the Ornaments which may be drawn upon the Dome, they alſo are to be determined in the ſame Manner; as will be evident by a very little Attention to the Figure, and by applying theſe Rules to Practice in a larger Scale than this upon the Plate.----The 80th Figure is the Repreſentation more nearly compleated, and between each Column I have introduced a Pannel to fill up the Vacancy, and to give a Hint how to introduce Ornaments proper for this Kind of Repreſentations; for whether Figures, Feſtoons, or any other kind of carved Ornaments, are intended, by inſcribing Squares about each, and by dividing them into ſmaller Squares, we may reticulate each Cell, which will be ſufficient for foreſhortning all Kinds of Ornaments.

CHAP. V.

The PERSPECTIVE *of* SHADOWS, *&c.*

SECT. I.

THIS Part of Perſpective has been very little attended to by moſt Writers upon the Subject, and yet it is very neceſſary to be known, and very eaſy to be underſtood; for it is built upon the ſame Principles as the Perſpective of Objects, and, therefore, is deducible from the ſame Rules. But I would not be underſtood to mean, that the Shadow of every particular Object upon the Picture is to be determined in the following Manner; no; my Intention is, only to give ſome general Principles, in order to explain the Reaſon and Nature of ſuch Shadows as are neceſſary in the Arts of Deſign; by which means the Artiſt will form a general Idea of the Perſpective of Shadows, and will be the better qualified to diſpoſe them in a Picture.

SHADOWS are either projected by the Sun, or elſe by a Candle, Torch, or ſome ſuch luminous Point. But ſince thoſe produced by a Candle, *&c.* are but ſeldom wanted, I ſhall therefore principally have regard to ſuch Shadows only as are projected by the Sun: Which may be reduced under the following Heads.

1. When the Light comes in parallel with the Picture.
2. When the Light comes from behind the Picture towards the Spectator.
3. When the Light comes from before the Picture.

In the firſt Caſe, the Shadows will be parallel to the Bottom of the Picture; but in the ſecond and third Caſes, ſince the Light comes in oblique with the Picture, therefore, both the Rays of Light, and the Shadows projected by them, will have their proper vaniſhing Points; and conſequently, the Shadows produced thereby will be oblique with the Bottom of the Picture. The vaniſhing Point of the Rays of Light will be either above the horizontal Line or below it; and thoſe Points will always be in Lines drawn from the vaniſhing Points of the Shadows, perpendicular to the horizontal Line: And we may moreover obſerve, that when the Light comes from behind the Picture, then the vaniſhing Point of the Rays of Light will be above the horizontal Line; but when the Light comes from before the Picture, then the vaniſhing Point of the Rays of Light will be below the horizontal Line: All which is exemplified in the following Figures. For in Figure 83, the Light is ſuppoſed parallel to the Picture; therefore the Shadows are parallel: In Figure 84, the Light is ſuppoſed to come from behind the Picture, and S is taken at pleaſure for the vaniſhing Point of the Shadow, and L for the vaniſhing Point of the Rays of Light: In the 85th Figure, the Light is ſuppoſed to come from before the Picture; and here S is the vaniſhing Point of the Shadow, and L the vaniſhing Point of the Rays of Light; which are both taken at pleaſure.

From hence then, and from the following Examples, it will be obvious, that after having drawn out any Perſpective Repreſentation, the Shadow of it may be very eaſily determined upon the Picture; therefore let us now apply what has been ſaid to Practice.

CASE I. *When the Light comes in parallel to the Picture.*

To find the Shadows of the Objects A *and* B, *which are ſuppoſed to be caſt upon the Ground.* Fig. 83.

Through all the Corners of the Bottoms of the Objects draw Lines parallel to the horizontal Line, and through every Corner of the Top of the Objects draw Lines parallel to each other for the Rays of Light, and their Interſections with the loweſt parallel Lines will determine the Appearance of the Shadows, as in the Figure: Thus a is the Shadow of A, and b of B.

From hence we may obſerve, that ſince EB is conſidered as a Ray of Light, therefore EBD is its Angle of Inclination with the Ground; or, in other Words, with the Plane of the Horizon. And we may alſo obſerve, that in Proportion as this Angle of Inclination of the Rays is greater or leſs, the Shadows will be longer or ſhorter; which accounts for the Reaſon why the Shadows of Objects are longer in a Morning and Evening, than when the Sun is at any conſiderable Height above the Horizon: All which may be clearly apprehended by attending to the Figure; or by drawing out other Figures, and then giving different Inclinations to the Rays of the Light.

CASE 2. *When the Light comes in from behind the Picture.*

Fig. 84. *To find the Shadows of the Objects* A *and* a, *which are ſuppoſed to be caſt upon the Ground.*

Take S at pleaſure in the horizontal Line, for the vaniſhing Point of the Shadow upon the Ground (for as the Shadow lies upon the Ground, it muſt vaniſh into the horizontal Line) and from this Point S, draw a Line SL perpendicular to the horizontal Line; then will SL be the vaniſhing Line of the Rays of Light, and, conſequently, ſomewhere in this Line will be the vaniſhing Point of thoſe Rays. Now, in this Caſe, the vaniſhing Point of the Rays is above the horizontal Line; therefore, take L at pleaſure for that vaniſhing Point, and from thence draw Lines thro' all the upper Corners of the Figures; then from the vaniſhing Point S of the Shadow, draw Lines through all the Bottom Corners, and their Sections with each other will be ſufficient Guides for compleating the Shadows, as in the Figure: Thus, L 3 being drawn through 1, and S 3 being drawn through 2, will give the Point 3 for the Shadow of the Point 1, and 2 3 for the Shadow of the Edge 1 2, *&c.*

Here let us obſerve, that in order to determine any Shadow, nothing more is required than to find the Places of a certain Number of Points upon the Picture; which Points are to repreſent the Shadows of all the upper Corners of any given Objects: Thus, 3 is the Shadow of 1, and 4 is the Shadow of A; therefore, draw 3 4, which is the Shadow of the upper Edge 1 A; and ſo of the reſt.

CASE 3. *When the Light comes from before the Picture.*

Fig. 85. *To find the Shadow of the Object* A, *which is ſuppoſed to be caſt upon the Ground.*

Here S is given for the vaniſhing Point of the Shadow, LS for the vaniſhing Line of the Rays of Light, and L for their vaniſhing Point; which, in this Caſe, is below the horizontal Line.----- From S draw Lines through all the lower Corners of the Object, and from L draw Lines through all the upper Corners of the Object, as in the Figure; and then their ſeveral Sections with each other will be ſufficient for compleating the Shadow, as before.

From theſe two laſt Figures alſo, we may obſerve, that the farther the vaniſhing Point of the Rays is taken from the horizontal Line, the ſhorter will be the Projection of the Shadows; and the contrary, the nearer it is placed to the horizontal Line: That is, the nearer it is to the horizontal Line, the leſs is the Angle of Inclination which the Rays make with the Ground, and the contrary the farther it is from it. Again, by inſpecting the two laſt Figures, we may perceive, that when the Light comes from behind the Picture, the Shadows will be caſt towards the Bottom of the Picture, and grow wider and wider continually, and the Front of every Object will be in Shadow; but in the laſt Figure, the Shadows will be caſt towards the horizontal Line, and will grow narrower and narrower continually, and the Front of every Object will be enlightened; and therefore, theſe Kind of Shadows are the moſt proper for a Picture, and conſequently, deſerve the moſt Attention: For which Reaſon, I ſhall henceforth ſuppoſe the Light to come in this Direction; and ſhall now proceed to ſhew how to determine the Appearance of Shadows as they are projected by different Planes, *&c.*

In the laſt Figure the front Side is parallel to the Picture, and the Method for finding the Shadow has been ſhewn already; therefore proceed we to a Figure whoſe Sides are oblique, though the ſame Rule is uſed in both Caſes.

To find the Shadow of the Object A, *which is ſuppoſed to be caſt upon the Ground.* Fig. 86.

From the vaniſhing Point S of the Shadow, draw Lines through the Bottom Corners, and from the vaniſhing Point L of the Rays of Light, draw Lines thro' the Top Corners, which (as before) will cut each other, and thereby give ſeveral Points, as Guides for compleating the Shadow.---If only the Shadow of the Top was required, then the Seats of each Corner muſt be found upon the Picture; and from thence the Appearance of the Shadow may be determined: Thus 2 is the Seat of 1, and 3 is its Shadow; and a is the Shadow compleated.

To find the Shadow of an oblique Object, which is ſuppoſed to be caſt upon the Ground.

Fig. 87. Here A is the oblique Side, S the vaniſhing Point of the Shadow, and L the vaniſhing Point of the Rays of Light.---From d draw d S, and from a draw a L; then will d c be the Shadow of d a; therefore by drawing b c, the Shadow will be compleated.

To find the Shadows of Objects when caſt upon different Planes.

Fig. 88. 1. *To find the Shadow of a perpendicular Object* A, *when it is caſt upon a Plane inclined to the Ground, but has ſome of its Edges, as* 1 2, *parallel to the Picture.*

From the lower Corners of the Object A draw Lines to S, and from the upper Corners draw Lines to L, which would determine the Shadow of A, upon the Ground; but this Shadow being cut by the Bottom 1 2 of the inclined Plane, therefore Part of the Shadow will be caſt upon it. Now, to find this Shadow, from b, (where the Line which is drawn from the loweſt Corner of the Object A cuts the Edge 2 n) draw b c perpendicular to the horizontal Line, cutting the inclined Edge 2 e, in c; then from b and c draw Lines parallel to the horizontal Line, and from a (where b a cuts the Line drawn from the other Corner of the Object to S) draw a d, which compleats the Parallelogram a b c d; finally, from where the Edge 1 2 cuts the Ground Shadow, draw Lines through c and d, which will cut the Lines drawn from the upper Corners of A to L, and thereby determine the Length of the Shadow upon the inclined Face of the Object, as in the Figure.

2. *To find the Repreſentation of a Shadow when it is caſt by an inclined Object upon a perpendicular Plane* e n r s.

From n and e draw Lines to S and L, which will give m for the Shadow of e, and 2 m n for the whole Shadow of the Side 2 n e; but ſince 2 m is cut by the Edge n r of the Plane e n r s, therefore, Part of the Shadow will be caſt upon it; which Shadow is determined by drawing a Line from o (where 2 m is cut by n r) to e; thus, n o e is the Shadow which is caſt upon the perpendicular Plane, and 2 o n is the Shadow that is caſt upon the Ground.

Fig. 89. 3. *To find the Shadow of a perpendicular Object* A, *when it is caſt upon a Plane* B, *that is every Way oblique with the Picture, but is nevertheleſs ſituated in ſuch a Manner as to have the vaniſhing Line* L P, *of the perpendicular Side* a b c, *paſs through the vaniſhing Point of the Shadow.*

From the upper and under Corners of A, draw Lines to S and L, as before; then, from where the Ground Shadow is cut by the Edge a 1, draw Lines to the vaniſhing Point P of the oblique Side B; which will cut the Lines drawn from the upper Corners of A, and thereby determine the Length of the Shadow.

4. *To find the Projection of the Shadow of a perpendicular Object* A, *when it is caſt upon an inclined Plane that is every Way oblique with the Picture.* Fig. 90.

Draw Lines from the upper and under Corners of A, to S and L, then, from where 3 S cuts the loweſt Edge 1 a of the farther Side of the inclined Object, draw a b perpendicular to the horizontal Line, and continue the inclined Edge 1 b 'till it cuts a b; then through a and b, draw Lines from the vaniſhing Point of the Edge 1 2, which will cut 4 S in c; then, from c draw c d parallel to a b, which will compleat the perpendicular Plane a b c d; finally, from where the Ground Shadow is cut by 1 2, draw Lines to b and d, which will cut 5 L and 6 L, and thereby give the Depth of the Shadow, as in the Figure.

Here let us take Notice, that as the Shadows of all Objects that are caſt upon the Ground will vaniſh into the horizontal Line, ſo, for the very ſame Reaſon, the vaniſhing Points of all Shadows which are caſt upon any inclined, or other Plane, will be ſomewhere in the vaniſhing Line of that Plane, as was obſerved in Figure 89.

The 91ſt Figure is an Example of the Shadow of a cylindrical Object A, caſt both upon the Ground and the Object B; and of the ſquare Object C, which is caſt upon the Ground and the Object D; which, it is preſumed, wants no Explanation.

Before I conclude with the Shadows projected by the Sun, I ſhall juſt obſerve, that altho' I have taken the vaniſhing Points of the Shadows always within the Picture, for the Conveniency of Room in each Plate; yet, it is to be obſerved, that, in general, the farther it is taken from the Picture the better.

Of Shadows projected by the Candle, &c. Fig. 92.

In Shadows of this Kind, nothing more is required than to have the Luminous Point, and its Seat upon the Ground; for by drawing Lines from thoſe Points through the upper and under Corners of each particular Object, the Shadow of that Object may be found, as in the former Figures; and only the Shape of the Shadows will be different; that is, they will grow wider and wider continually, the farther they are projected. I have given ſeveral Examples in this Figure, and have put every Line and Point that is neceſſary in each Operation; which, it is preſumed, is ſufficient for the Purpoſe.

SECT.

SECT. II.

HAving ſhewn how to determine the Appearance of Shadows, I might now proceed to the Conſideration of Aerial Perſpective, *&c.* but as that is handled at large in the laſt Chapter of the firſt Book, the Reader is now referred to that: However, by way Supplement to what is there advanced upon the Subject, I ſhall beg leave to make the following Obſervations. For, ſince various have been the Opinions about the Colour of Shadows, and as various the Methods purſued by Painters and other Artiſts, I ſhall therefore only offer a few Hints taken from Nature, which perhaps may be of Service to the young Tyros in the Arts of Deſign.

By Shadow then, in this Place, I mean the Colour of that Part only of an Object, which is either turned from the Light, or is wholly in the Shade. Fig. 94. Suppoſe, for Inſtance, the Pillar W to be placed near this Side of the Wall b, and ſuppoſe alſo, that the Rays of Light came from the other Side of the Wall; then, it will be evident, that Part of this Object will be enlightened, and Part will be wholly in Shadow. Now, that Part which is wholly in Shadow, is of the ſame Colour as the whole Object would be of were the Sun not to ſhine upon it; or, in other Words, 'tis of the ſame Colour which the whole Object would be of in common Light. From whence I infer, Firſt, (allowing for the different Accidents of the Sun's Light, the Air, *&c.*) that the Shadow of the Pillar W, is the real Colour of that Object in common Light, but being oppoſed to a ſuperior Light, is, in compariſon of that ſuperior Light, a Shadow. Secondly, That therefore the Colour of all Shadows muſt be proportionably lighter or darker, as that Object to which it is a Shadow, is of a lighter or darker Colour. This I have explained in the following Manner. The Objects W, W, I ſuppoſe to be White; the Object Y, to be Yellow; the Object G, Green; the Object R, Red; the Object B, Blue; and the Object 𝔅, Black.---Here the ſhadowed Parts of each particular Object is made darker and darker, in proportion as the Colours of the ſeveral Objects proceed from White to Black; which is evident by the Figure. Thirdly, Since then the Shadows of all the above Objects are nothing more than the Effects of common Light, compared with the Effects of the ſuperior Brightneſs of the Sun; and ſince Objects are as diſtinctly ſeen by a common uniform Light, as they are in the Sun-ſhine; therefore thoſe Objects which are in Shadow, ſhould be as highly finiſhed, and their Parts as well made out, in the Picture, as are the Parts of their neighbouring Objects, which are in the higheſt Light. And fourthly, from hence it follows, that the Shadow of every Object muſt partake of the real Colour of that Object; and therefore, Black can never be the Shadow of White, nor of any other Colour than that of Black.

By thus ranging the Colours in their proper Orders, we may eaſily conceive the Degree of Darkneſs which is peculiar to the Shadow of each Colour. And if any one would moreover ſatisfy himſelf of the Truth of this, let him have a Number of ſquare Pieces of Wood, painted of different Colours; then, by oppoſing one Side to the Light, the Degree of Shadow will be very viſible.

And from hence alſo we obſerve, that the ſtronger the Light ſhines upon any Object, the darker will be its Shadow; for in Proportion as the Sun ſhines ſtronger or fainter upon an Object, the Oppoſition of the Light and Shadow will be greater or leſs; and conſequently, the more perceptible will be the Shadow. And this accounts for the Blackneſs of Shadows by Candle or Torch-Light; becauſe, the violent Oppoſition between Light and Darkneſs, together with the Smallneſs of the Light and the Faintneſs of the Reflections, muſt produce that Effect.

From theſe Obſervations then it appears, that the Colour and Degree of Darkneſs to each Shadow, is abſolutely neceſſary to be known, and ought to be well underſtood, in order to produce a good Effect in a Picture, or to repreſent any Object as it appears in Nature. It is in this, and in a proper Diſtribution of the Lights and Shadows in a Picture, that the *Chiara Obſcuro* conſiſts; and it is this, and this only, which can give a Clearneſs to any Shadow, whether in a Painting, Print, or Drawing.

I ſhall juſt offer a few Hints for determining the Appearances of the Reflections of Objects in Water, *&c.* and to put an End to this Chapter.

The Reflections of Objects in Water, or any other tranſparent Medium, may be conſidered, Firſt, as to their Colour; and, Secondly, as to the Length of their Reflections. As to their Colour, If the Medium be very clear and tranſparent, the Colour of the Reflections is very near the Colour of the Objects; but in a thick or dirty Medium, the Reflection of an Object very ſenſibly changes its Colour, and partakes more and more of the Colour of that Medium in proportion as it is more denſe and muddy, 'till, at laſt, the Reflection will entirely diſappear. And in order to make Water appear tranſparent (which is done principally by means of Reflections) the Reflections ſhould be as perfect as poſſible.

To determine the Reflection of any Object in Water.

Fig. 93. Let 1 be an Object ſtanding upon a Hill, and a its Bottom; then continue the Sides of the Object downwards, at pleaſure (as the prickt Lines in the Figure) and ſuppoſe c is where the even Ground cuts the Bottom of the Hill; then ſet off cd equal to c1, which will give the Length of the Reflection. Again, for the Object 3, which ſtands upon the flat Ground; make the Length of the Reflection f equal to that Object. The Object 4 is too far from the Water to be reflected by it; and the Reflections of the Objects o, n, g, which are floating upon the Water, are each equal to the Height of its peculiar Object. So alſo as to the inclined Object 2; the Reflection of that muſt have the ſame Angle of Inclination with the real Object, and be of the ſame Length, as in the Figure. From which it appears, that all Kinds of Reflections are very eaſily determined; ſince nothing more is required, than to ſet off the perpendicular Height of each Object, downwards, upon the Water, *&c.*

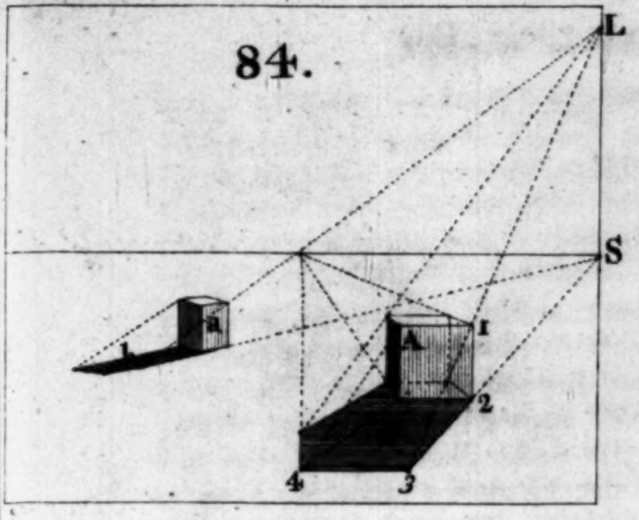
What has been advanced upon Reflections, relates only to a ſtagnating Medium; that is, a ſtill or ſmooth Water, or the like; which is fitteſt for an Explanation of this Matter, and will be ſufficient for giving the Learner a general Idea of Reflections: But when either the Objects, or the Water, or both together, are in Motion, then, though the Reflections will be wavering and uncertain, yet the above Rules will be of great Service in ſuch Caſes; and eſpecially, if they are joined to the Study of Nature.

I cannot conclude this Head without the following Quotation from Mr. *Pope*'s Second Paſtoral; which, to me, ſeems an inimitable Picture of Nature, and much to our preſent Purpoſe.

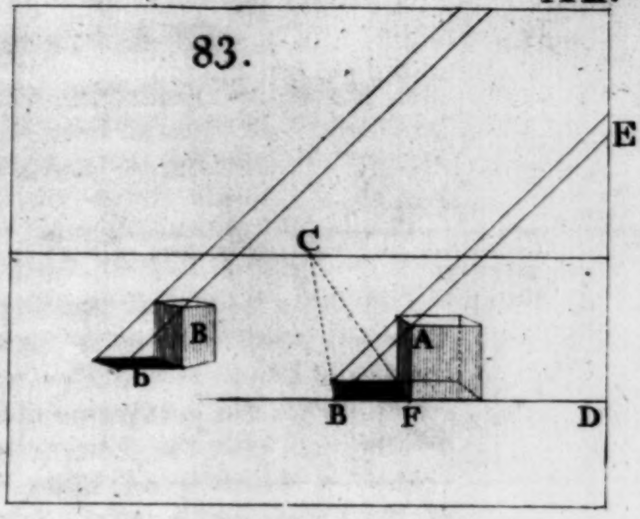
" A Shepherd's Boy (he ſeeks no better Name)
" Led forth his Flocks along the ſilver *Thame*,
" Where dancing Sun-Beams on the Waters play'd,
" And verdant Alders form'd a quiv'ring Shade."

I have

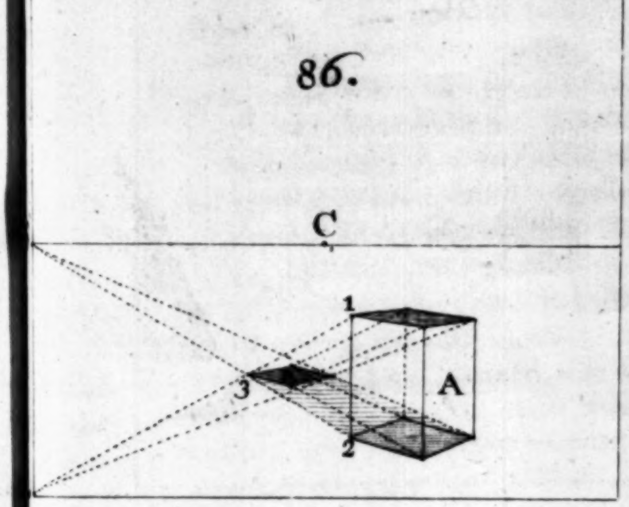
84.



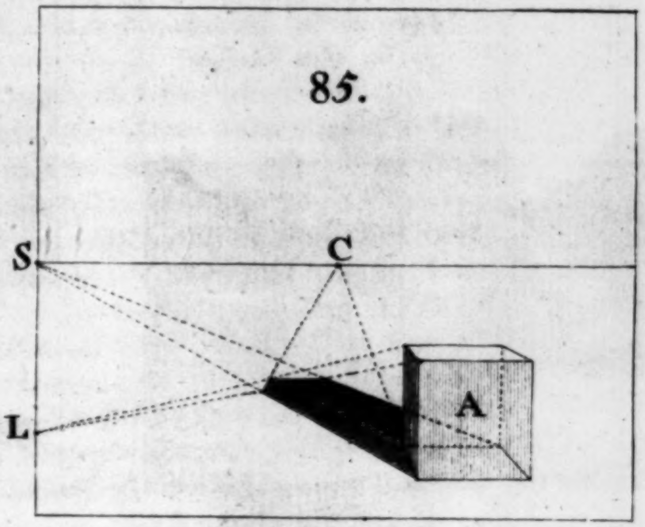
83.



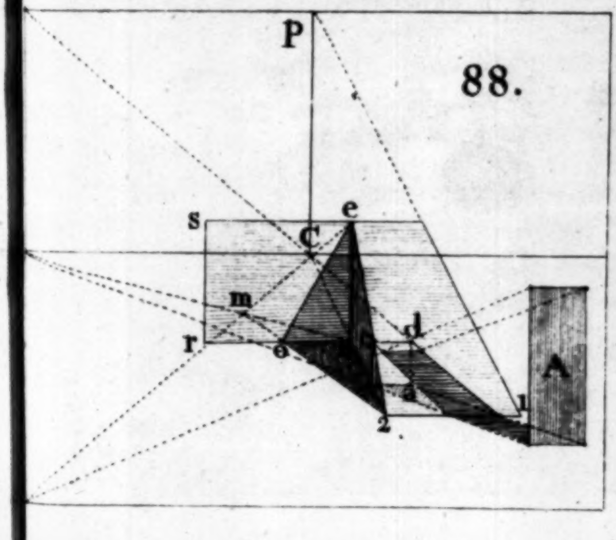
86.



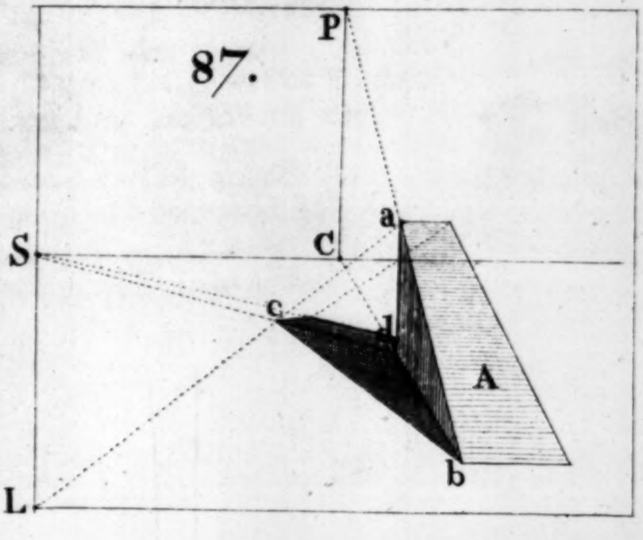
85.



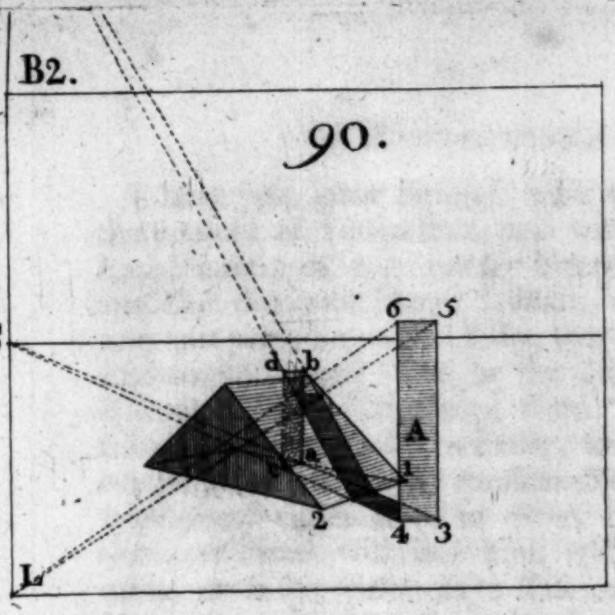
88.

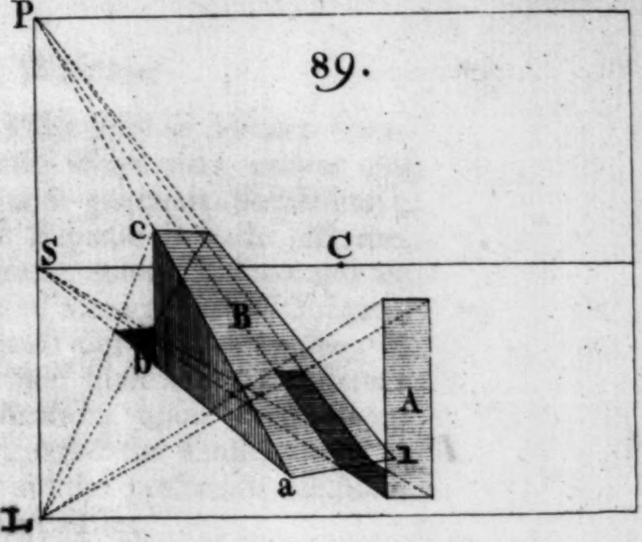


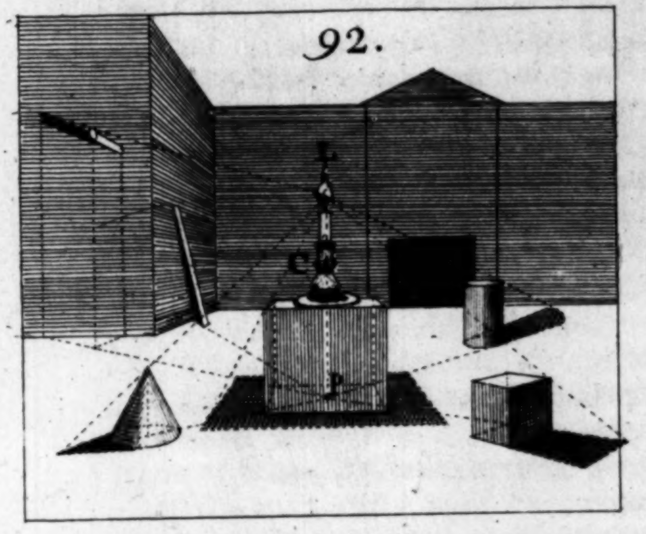
87.

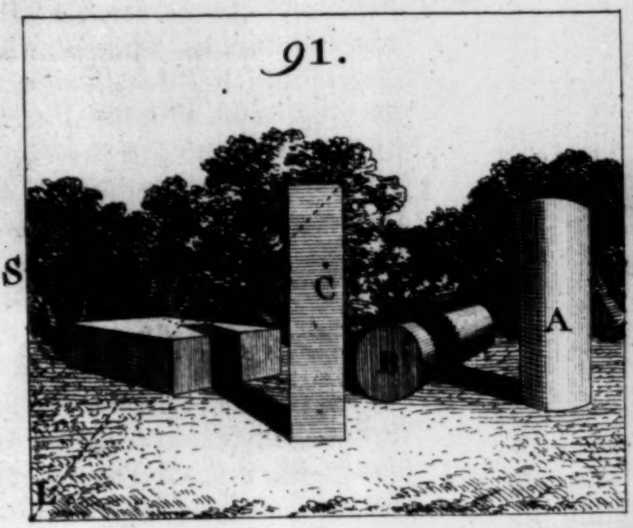


BRITISH 1 JY64 MUSEUM

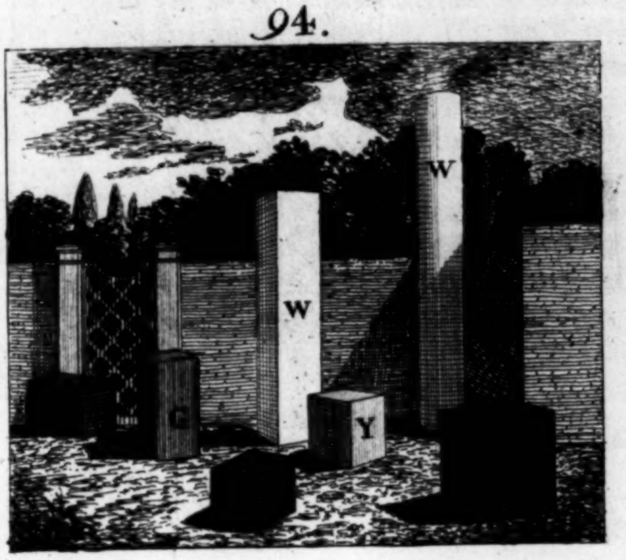

90.


89.

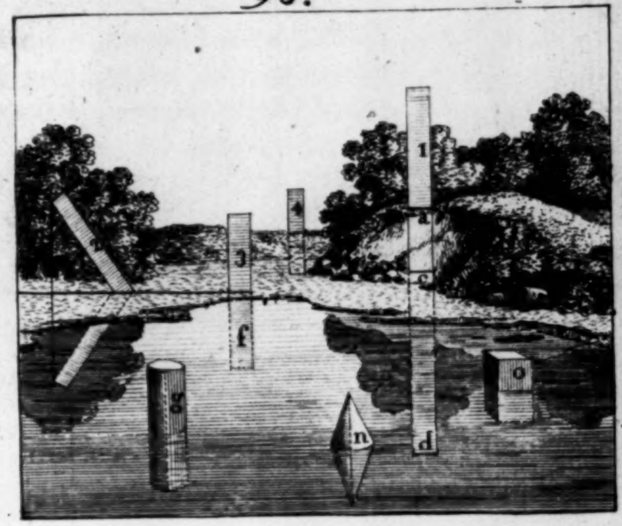

92.


91.

94.



93.



BRITISH 1 JY64 MUSEUM

I have now gone through with all I intended to advance upon the Subject of Perſpective, and wiſh the Work may anſwer the Expectations of my worthy Friends and generous Subſcribers; and that the great Pains, Labour, and Expence it hath coſt me, may not prove in vain. I ſay, that here I intended to have put an End to my Subject; but, by the Deſire of ſome particular Friends, I ſhall take a Tranſcript from *Pozzo* and Mr. *Hamilton*, in relation to SCENE-PAINTING; and then ſhall add the different Methods of the moſt conſiderable Authors upon Perſpective; which may either ſerve to divert or inſtruct the Reader, and, at the ſame Time, will ſhew him, which are the preferable Methods, mine, or theirs, either as to Eaſe or Expedition.

CHAP. VI.

Of SCENOGRAPHY; *or* SCENE-PAINTING.

“SCENOGRAPHY is the Art of Painting upon ſeveral “Planes, or Scenes, at different Diſtances, and in various “Poſitions with reſpect to the Eye, in ſuch a Manner that “all thoſe different Scenes, when ſeen from one certain determi-“nate Point, may correſpond with each other, and repreſent one “entire View of the Deſign without Breaks or Confuſion, as if “it were one continued Picture.” This is Mr. *Hamilton*'s Explanation of SCENOGRAPHY; who has handled this Subject in a very clear and comprehenſive Manner, both in Theory and Practice; and therefore, what I intend to offer upon it myſelf, ſhall be principally an Abſtract from him. For, ſince 'tis impoſſible for me to treat it in a better Manner than he has done before me, I ſhall therefore refer my Reader to his and *Pozzo*'s* Books, if what I ſhall offer be not ſufficient for his Purpoſe; and in order to be as conciſe as poſſible, I ſhall ſuppoſe him to be acquainted with the Nature and Conſtruction of Theatres in general, and that he only wants to know, how to draw ſuch Repreſentations as are proper for ſuch Places.

The Deſign of Scene-Painting, is not only to decorate the Theatre, but to make that Part of it which lies beyond the Stage, appear much longer than it really is. This is effected by raiſing the Floor to a certain Angle, by ſloping the Cieling, and by raiſing the Scenes in ſuch a Manner, that both Floor, Cieling, and Scenes, ſhall be a Part of a hollow Pyramid, like L l O o N n M m, which, if continued, would meet in the Point T; and after having diminiſhed each Scene in its due Proportion, then by drawing thereupon the intended Deſign, by the common Rules of Perſpective, ſo that every Scene, when put in its proper Place, ſhall appear as a Part of the general Deſign.

Fig. 95.

As to the Inclination of the Floor and Cieling, and alſo the Ranging, and the Space between each Scene, theſe, as I obſerved before, I ſhall ſuppoſe my Reader acquainted with, and therefore, ſhall have Regard only to the drawing Perſpective Repreſentations upon Planes ſituated in the above Manner.

---

* *Andrea Pozzo*, in both his Books upon Perſpective, has alſo been very copious upon the ſame Subject.

Here

Fig. 95. Here ABFD is that Part of the Theatre which is allotted for the Spectators, KGLM the Proſcene, LMON the Curtain, abcd the Aperture in the Curtain through which the Scenery is ſeen, MLml the Floor upon which the Scenery is placed, PQRS the farther End of the Theatre, E the Eye, EH its Height above the Floor ABDF, h its Seat upon the horizontal Plane efQP, and T the Center of Contraction for the Scenes, Floor, *&c.*

Fig. 96. Now let ABCD be a Plan of the Theatre, ee the Seat of the Curtain, ML the Opening of the Curtain, bb, *&c.* the Grooves for the Scenes to ſlide in, H the Eye, and T the Point of Contraction.——Here the Diſtance CH of the Eye from the Curtain, is not taken ſo great as in the laſt Figure; for, was the Point of Sight placed at one End of the Houſe, then the moſt ordinary Part of the Company would have the beſt View of the Scenery; and therefore, about the Middle of that Part of the Houſe which is allotted for the Spectators, is thought the moſt proper Place for the Eye; as in the Figure.

And having determined the Plan for the Scenery, and fixed the Point of Sight and Center of Contraction, let us next determine the Height of the Eye, and the Height of the ſeveral Scenes.

Fig. 97. Let ABCD be a perpendicular Section of the Houſe in the Line OT (Fig. 96.)——Draw Lines perpendicular to HT from the Points H and T, 'till they cut the Line CS of the 97th Figure in the Points h and S; then is h the Seat of the Eye, and S the Seat of the Point of Contraction: Again, continue the parallel Lines through the Seats of the Scenes 'till they cut the Line CS in I, 1, 2, 3, 4, which will give the Diſtance between each Scene; and from the Point I draw Ie, for the Inclination of the Stage, and continue it beyond T, at pleaſure: Then, for the Height of the Eye and Point of Contraction, make Eh in this Figure equal to Eh in Fig. 95,[*] and draw ET parallel to CS, cutting IT in T; then is Eh the Height of the Eye, and T the Point of Contraction.

From hence it is evident, that ſince the Floor Ie is fixed, the Point of Contraction muſt be governed by the Height of the Eye. For let xh be the Height of the Eye; draw xe parallel to hS, and then is e the Point of Contraction; and in Proportion as the Height of the Eye is greater or leſs, the Point of Contraction will be nearer or farther off. By this Method of varying the Height of the Eye, great Variety of Scenery may be introduced; but how far 'tis allowable to alter the Height of the Eye in Scenes for the ſame Entertainment, muſt be left to Experience to decide: However, this we may obſerve, that it ought never to be above the Middle of the Opening of the Curtain, (that is, above s in Fig. 95) nor much below the Face of an Actor upon the Stage. And in regard to the Point of Contraction; it is not neceſſary to have it upon the End of the Wall, at t, but it may, and ought in general, to be placed beyond it: For when it is placed at the End of the Houſe, then the Scenes will be too ſuddenly diminiſhed, and will have a diſagreeable Effect, beſides other Inconveniencies.

---

[*] The Reaſon why Eh is taken for the Height of the Eye, and not EH, is, becauſe efQP is conſidered as the Ground Plane upon which the Picture is ſuppoſed to ſtand. Fig. 95.

Fig. 97. Again, for the Height of the Scenes.——The Line r s is the perpendicular Section with the Curtain; and the Curtain being conſidered as a Picture, therefore C is the Center of the Picture; and therefore, upon the Line r s ſet off the ſeveral Diſtances from s, for the hanging Scenes and Tops of the ſide Scenes; thus c is for the Tops of the Scenes, and s a for the Widths of the hanging Scenes; therefore, from s, c, a, draw Lines to T, which will give the Height of each Scene, *&c.* as in the Figure.

Fig. 96. The Side Scenes are made to project beyond the Line M m, *&c.* which meaſures the Opening of the Curtain; and they ſhould be brought ſo forward upon the Stage, that a Line H b, drawn from the Seat of the Eye thro' the Corner of the firſt Scene a, may meet the ſucceeding Scene in the Point b, where it is cut by M m: For, by this Means, the Spaces between the Scenes will not be viſible to many of the Spectators, but the whole together will appear like Fig. 97. one continued Picture. In like Manner, Lines drawn from the Top Corner of each Scene, as b, of the Scene f b, to the Eye, will give c a for the Width of the hanging Scenes.

Fig. 96. Again, if Lines are drawn through the Points f, g, h, i, 'till they cut the Line e D, then theſe Points f, g, h, i, will be the Projections of the Points 1, 2, 3, D upon the Floor of the Stage, and conſequently, the oblique Line e i, will, to the Spectators at E, appear to be equal to the Line e D; ſo that the Back Scene in the Line i k, will appear to be as far from the Eye as the End of the Houſe C D; and, by that means, the Depth of the Theatre will appear to be much greater than it really is.

Having made theſe neceſſary Preparations, we will now proceed to ſhew how to draw the Repreſentations upon each Pair of Scenes, ſo that the whole, when viewed from a proper Point, ſhall appear as one continued Picture.

To prepare a Pair of Side Scenes for Painting.

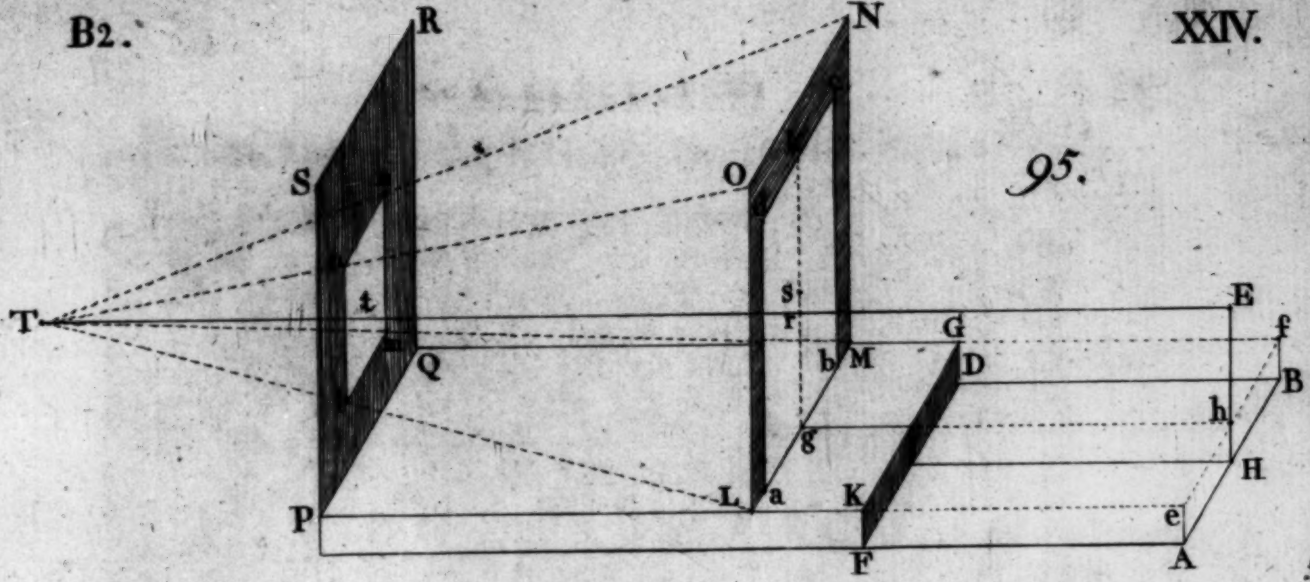
Fig. 98.

Draw ac at pleaſure, which call the Line of Interſection that the Scenes make with the Floor of the Stage; then from any Point c, erect the Perpendicular cE, and from the Plan (Fig. 96) take the Diſtances dx, dx, which the Scenes xb, xb, are from HT, and transfer them from c to b; take alſo the Width of each Scene, and transfer it from b to a, as in the Figure; then continue Cc downwards, and make cg equal to f1, (Fig. 97) and draw fh parallel to aa: Then are ab, da, the Seats of the ſecond Pair of Scenes, and gc their Height from the horizontal Plane efQP. (Fig. 95.) And ſo alſo for the Height of the Scenes;—From a, b, d, a, draw Lines parallel to gE, then take the Height fb of the ſecond Scene, (Fig. 97) and ſet it from b to i; which gives the proper Height. Again, for the horizontal Line and Center of the Picture;—Take 1d (Fig. 97) and ſet it from g to C, and through C, draw HL parallel to aa; then is HL the horizontal Line, and C the Center of the Picture. In like Manner, the Diſtance of the Eye for each Pair of Scenes is to be determined;—Thus Ed (Fig. 97) is the Diſtance of the Eye from the Scene fb; therefore, ſet off CE in this Figure equal to Ed in the 97th Figure: And having got the proper Diſtance of the Eye for one Pair of Scenes, *&c.* we are to proceed with our Work in the very ſame Manner as if it was an upright Picture. And the ſame Methods are to be taken for all the other Side Scenes, the Back Scene, *&c.* taking their Breadths from the Plan, and their Heights from the Elevation: All which may be very eaſily done by drawing a ſmall Model, according to the above Rules, and then transferring the ſeveral Parts unto each Scene, *&c.*

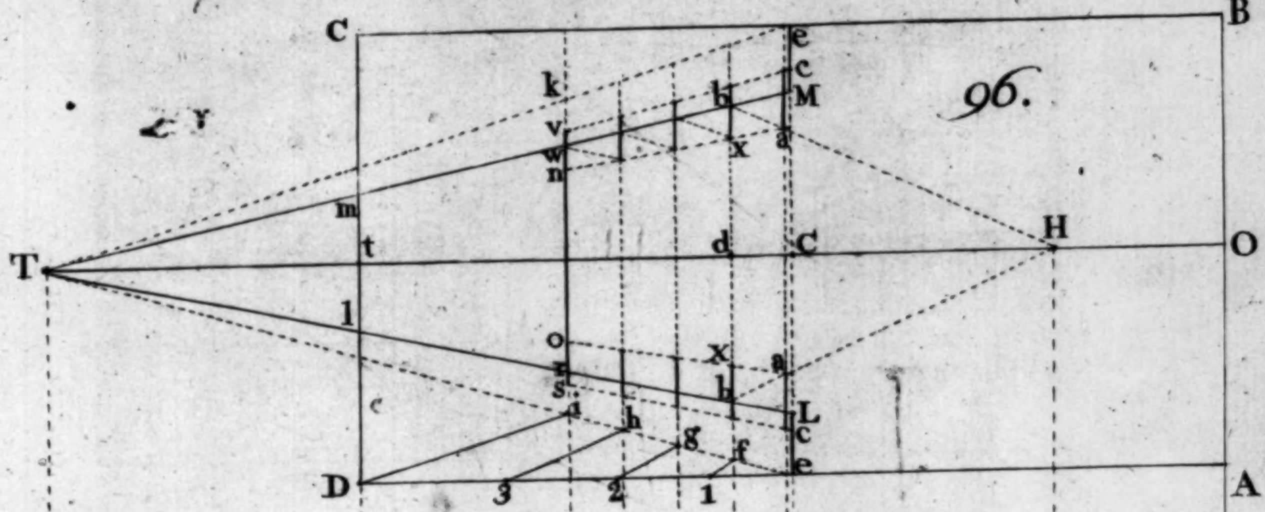
Or this may be done by conſidering the Curtain as a Picture which is to repreſent the whole Deſign, and upon which are drawn the ſeveral Parts proper for each Scene; then by reticulating the whole, as in the 101ſt Figure, we may transfer the Part peculiar to each Scene, in the ſame Manner as one Picture is copied from another by the common Method of Net-work: But we muſt take great Care to divide each Scene exactly in the ſame Manner as that Scene is divided by the Reticulation upon the Curtain.

And here it is neceſſary alſo to obſerve, that ſince the Space If, (Fig. 97) which is the Diſtance between the Scenes In and fb, repreſents the whole Space from I to o; therefore, no Part of the Diſtance Io ſhould be drawn upon the Scene fb; but all that comes within that Diſtance, ſhould be painted upon the Scene In: And ſo of the reſt.

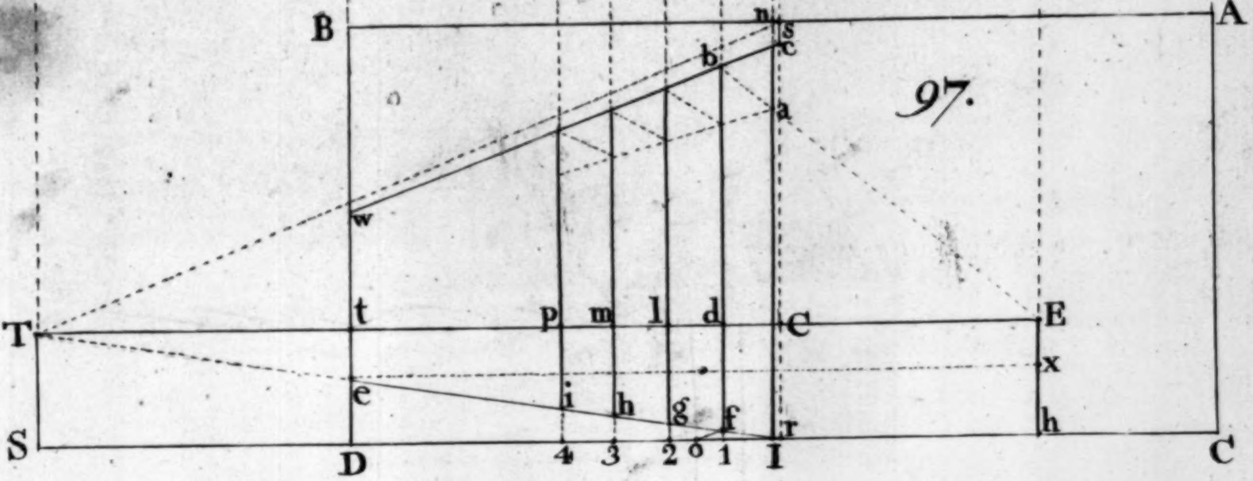
Again, we muſt take Care to give each Scene ſuch a Projection, that a Line drawn from the Eye through the Edge of one Scene, may cut its ſucceeding Scene in a proper Manner; as was obſerved before: For which Purpoſe we may uſe the following Method.—— *Fig.* 99. Set off the ſeveral Widths for the Opening of the Curtain, and Width of the Scenes, from the 96th Figure, upon the Line af, (which I here ſuppoſe the Bottom of the Model;) draw alſo the horizontal Line, *&c.* then, from the Points a, b, c, d, e, f, draw Lines to C, and make ag equal to If (Fig. 97;) then draw gm parallel to af, and ſet off the ſeveral Diviſions gh, hi, *&c.* from g towards m; then draw Lines from all thoſe Points to C, as in the Figure. Thus, again, ſuppoſe no the Seat of the firſt Scene; then draw np, cutting Ck in p; and then is np the Height of the firſt Scene. Again, from the Point 2, where the Edge of the firſt Scene cuts eC, draw 1 2, which will cut Cd in 1; then is 1 2 the apparent Breadth of the ſecond Scene: And ſo of the reſt.—— In the 100th Figure is a Set of Scenes compleated; where C is the Back Scene, which parts in the Middle; 1, 2, 3, 4, the Side Scenes; and the prickt Lines ab, *&c.* are the Hanging Scenes.


R
N
S
O
t
s
r
T
E
f
G
Q
b
M
D
B
h
g
H
L
a
K
P
e
F
A

95.

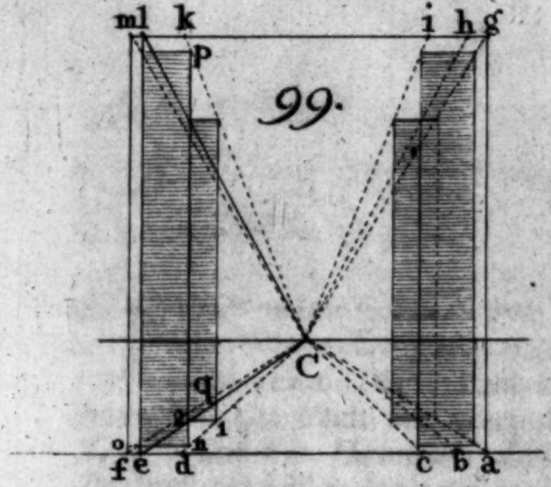

C
e
B
c
k
b
M
v
x
a
w
n
m
T
t
d
C
H
O
1
o
x
a
s
b
L
c
i
h
g
f
e
D
3
2
1
A

96.

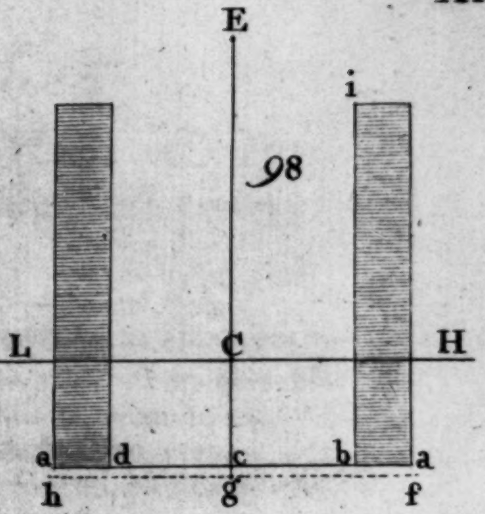

n
A
B
s
c
b
a
w
T
t
p
m
l
d
C
E
x
e
i
h
g
f
r
h
S
D
4
3
2
o
1
I
C

97.

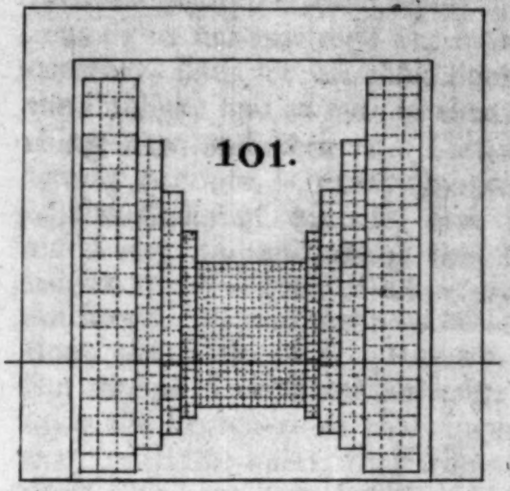
BRITISH 1 JY64 MUSEUM



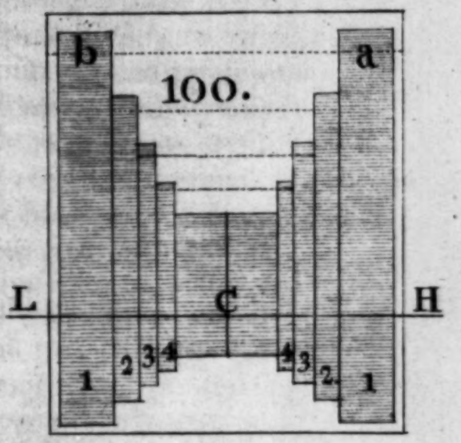
99.



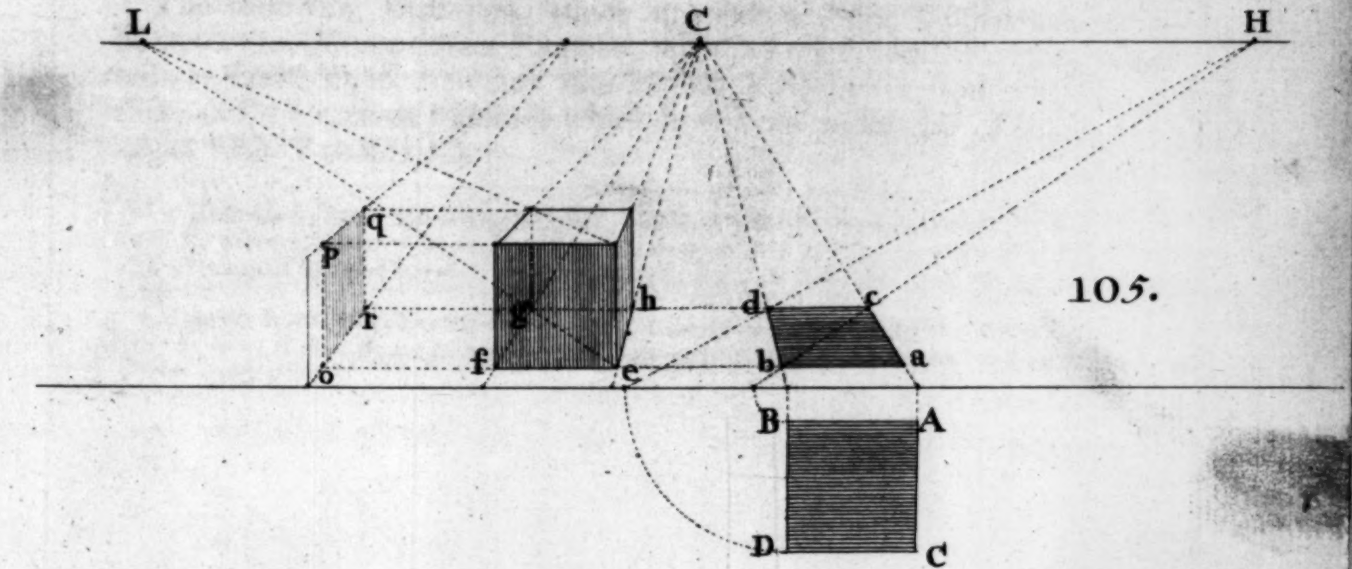
98



101.



100.



105.

BRITISH
1 JY64
MUSEUM

CHAP. VII.

An Abſtract of ſeveral Methods of Perſpective; tranſcribed from the moſt eminent Authors.

THE oldeſt Books which I have met with upon the Subject of Perſpective, are, one by VIGNOLA[*], and another by MAROLOIS[†]. And theſe two Authors ſeem to me, to have laid the Plan for every Syſtem of Perſpective (except Dr. *Taylor*'s and Mr. *Hamilton*'s) ſince their Times; though few of the Authors who have built upon their Principles, have been ſo generous as to acknowledge their Obligations to them; but, on the contrary, have ſet off their Books with pompous Titles, to allure the Publick, and to raiſe in them an Expectation of finding ſomething new and curious. This, though a Practice too common among Authors, is, in my Opinion, an unpardonable Tranſgreſſion of the Rules of Modeſty and Plain-dealing; and therefore, to avoid any Imputation of this Kind, I have conſtantly acknowledged my Obligations to every Author who has lent me any Aſſiſtance. It was for this Reaſon, principally, that I gave my Book the Title of Dr. BROOK TAYLOR'S PERSPECTIVE, &c. But though I muſt acknowledge my Work to be generally built upon the Principles of that ingenious Author, I hope, I may at the ſame Time aſſert, that whoever will compare my Schemes with thoſe that have been before made publick, will find very few but what are intirely of my own Invention.

The following Examples, which are taken from VIGNOLA, MAROLOIS, VREDEMAN FRIESE, the JESUIT, and POZZO, will be ſufficient to ſhew how one Author has copied from another, and the various Methods which have been publiſhed. I ſhall begin with VIGNOLA'S.

---

[*] *Vignola* was a famous *Italian* Architect, who flouriſhed in the Beginning of the 15th Century: He wrote a Treatiſe upon Perſpective, which was publiſhed in 1644, by *Filippo de Roſſi*, with Annotations by *Ignatius Danti*. It was printed in Folio at *Rome*, and is in the *Italian* Language.

[†] This Work was printed in Folio at the *Hague*, is in *Latin*, and was engraved and publiſhed by *Henry Hondius* in 1615; and though tedious in its Operations, is nevertheleſs a very curious Performance.

I. VIGNOLA's METHOD.

To put a CUBE *into Perſpective.*

Fig. 102. Here AC is a perpendicular Section of the Picture, AB is the Bottom of the Picture, and C the Center of the Picture, E the Eye, and ES its Height, D is the Elevation of the Cube, and F its Plan upon the Ground. Now, having ſettled the above Requiſites, draw Lines from every Corner of the Elevation D, to the Eye E, and from the Plan F draw Lines from every Corner to the Seat of the Eye at S; and their ſeveral Interſections upon the Line BC, will give the proper Meaſures for the Height and Depth of the propoſed Repreſentation. Thus, from the Points 1, 2, 3, 4, on the Line of Elevation AC, draw Lines parallel to the horizontal Line; then from the Line AB of the Plan, take Ab, ba, and ſet from 1 to a, and take Ac, cd, and ſet from 2 to d; which will give the proper Heights and Depths, as in the Figure. Or, by ſetting off A 5, 5 6, equal to 7 8, 8 9, and drawing Lines to C, we may get the Depth of the Plan abcd.

By this Method, we are taught how to make a perſpective Scale for any Repreſentation: For having drawn the Elevations and Plans of the propoſed Objects, the Line AB may be conſidered as a Scale for the Plans, and the Line AC as a Scale for the Elevations.

II. MAROLOIS's METHOD.

To put a DOUBLE CROSS *into Perſpective.*

Fig. 103. Here ce is the Ground Line, DG the horizontal Line, C the Center of the Picture, and CD the Diſtance of the Eye.——Draw out the Plan of the Croſs, as A, and put it into Perſpective, as in the Figure; then, at any convenient Diſtance c, raiſe a Perpendicular cd upon the Ground Line, and ſet the Elevations a, 1, 2, b, upon it; then from c, 3, 4, d, draw Lines to any Point H in the horizontal Line; after which, draw Lines through every Angle of the Plan, parallel to the horizontal Line, which will cut the Line cH, and thereby give the Points by which the Perſpective B of the Elevation may be compleated; finally, from every Angle of the Plan draw Lines perpendicular to the horizontal Line, and from every Angle of the Elevation draw Lines parallel to the horizontal Line; and then, their mutual Interſections with each other, will produce the propoſed Repreſentation, as in the Figure.—The Reader is deſired to compare this with my Method in the 40th Figure.

III. JAN VREDEMAN FRIESE's METHOD.[*]

To put a CUBE *into Perſpective.*

Fig. 104. Make the Bottom BP of the Picture a Scale of Feet, from whence find the Repreſentation of any Number of Geometrical Squares, as in the Figure.——Now let it be required to find the Appearance of a Cube a b c d, equal to two Feet in Diameter, and let it be one Foot from the Bottom of the Picture.—Make the Front Face a b c d two Squares wide and two Squares high, then give two Squares for the Depth, and from thence compleat the Figure.

IV. *The* JESUIT's METHOD.[†]

To put a CUBE *into Perſpective.*

Fig. 105. Draw the Plan ABCD, which put into Perſpective, as a b c d; from thence draw another Plan e f g h, then, by *Marolois*'s Method, find the Elevation, and from thence compleat the Figure.——And this ſame Method is taught by *Kircher*, in his Work, entituled, *Ars magna Lucis et Umbræ*, Chap. 3.

V. ANDREA POZZO's METHODS.[‖]

1. *To put a* PARALLELOPIPED *into Perſpective.*

Fig. 106. Draw the Elevation A, and from thence the Plan B; then put the Plan into Perſpective, as a g f d; from the Corner a of the Plan, erect the Perpendicular a b, and continue the Top of the Elevation A 'till it cuts a b in c; from whence the Perſpective Elevation may be compleated by *Marolois*'s Method. And having got the Depth of one Plan, and the Height of the Elevations, the whole Repreſentation may be compleated by *Vignola*'s Method.

2. *To put a* PARALLELOPIPED *into Perſpective, which will explain* POZZO's *other Method.*

Fig. 107. Here in Conformity to *Vignola*'s Perſpective Scale, AC is the Section of the Picture, AB the Ground Line, D the Elevation of an Object, and F, H, the Plans of two Objects parallel to the Picture; ſo likewiſe, E is the Eye, E S its Height, and I is conſidered as the Seat of the Eye.——From the ſeveral Angles of the Elevation draw Lines to the Eye E, and from the ſeveral Angles of the Plans draw Lines to I, which will cut BC, and thereby give the Elevations and the Depths of the Plans; from whence the 108th Figure may be compleated. Thus, A 1, A 2, A 3, A 4, are each equal to their correſponding Diviſions, A 1, A 2, A 3, A 4, upon the Line of Elevation A C, Fig. 107; and 10, 11, *&c.* are equal to K 6, K t, *&c.* of the ſame Figure; and A C is equal to the Height of the Eye S E. But I have put every Line and Point, to explain the Thing the better.

---

[*] This Book is a Folio, in *French*, was printed at the *Hague* in 1619. It was corrected by *Marolois*, and engrav'd by *Henry Hondius*.

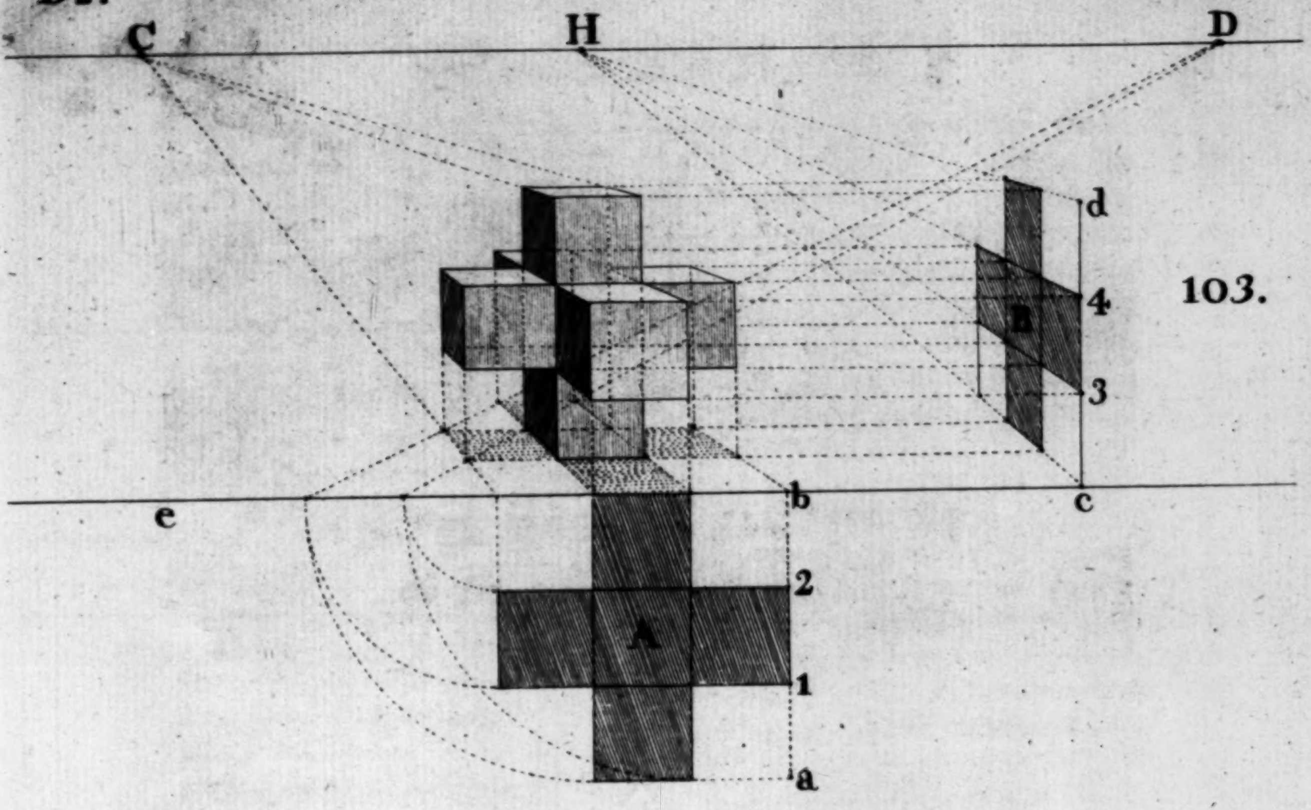
[†] This Book is in Quarto, was wrote originally in *French* by a Jeſuit at *Paris*, was tranſlated into *Engliſh* by *E. Chambers*, and was printed at *London* in 1726.

[‖] His firſt Book was publiſhed in *Latin* and *Engliſh* by *John Sturt*, Engraver, in 1707; and his ſecond Book was publiſhed by himſelf, in *Latin*, in 1700; and are both in Folio.

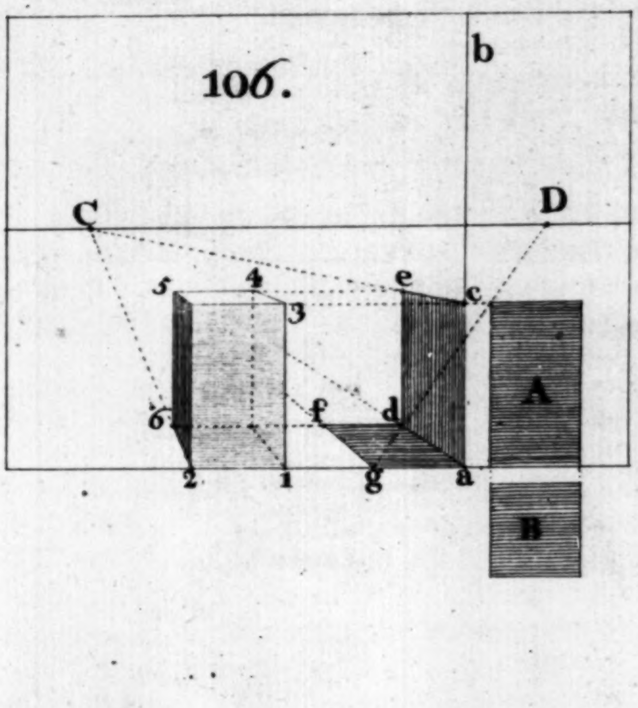
There are ſeveral other ſmaller Treatiſes upon Perſpective, and particularly one by *Bernard Lamy*, entituled, *Perſpective made Eaſy*, which, as it contains ſome curious Obſervations upon Painting, *&c.* is worthy of Notice.

F I N I S.

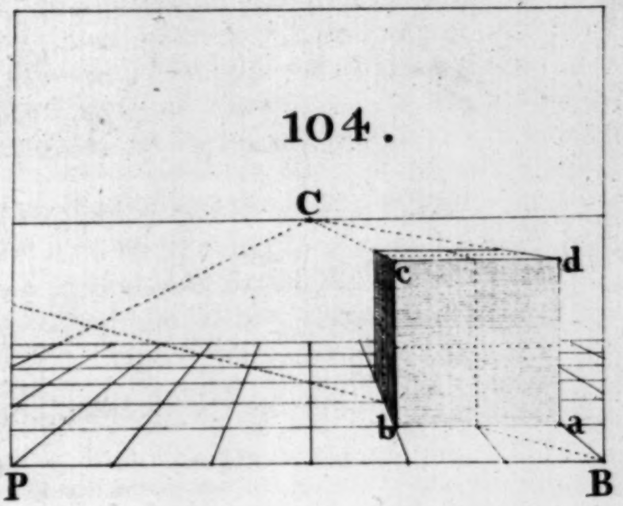
1 JY 64



103.

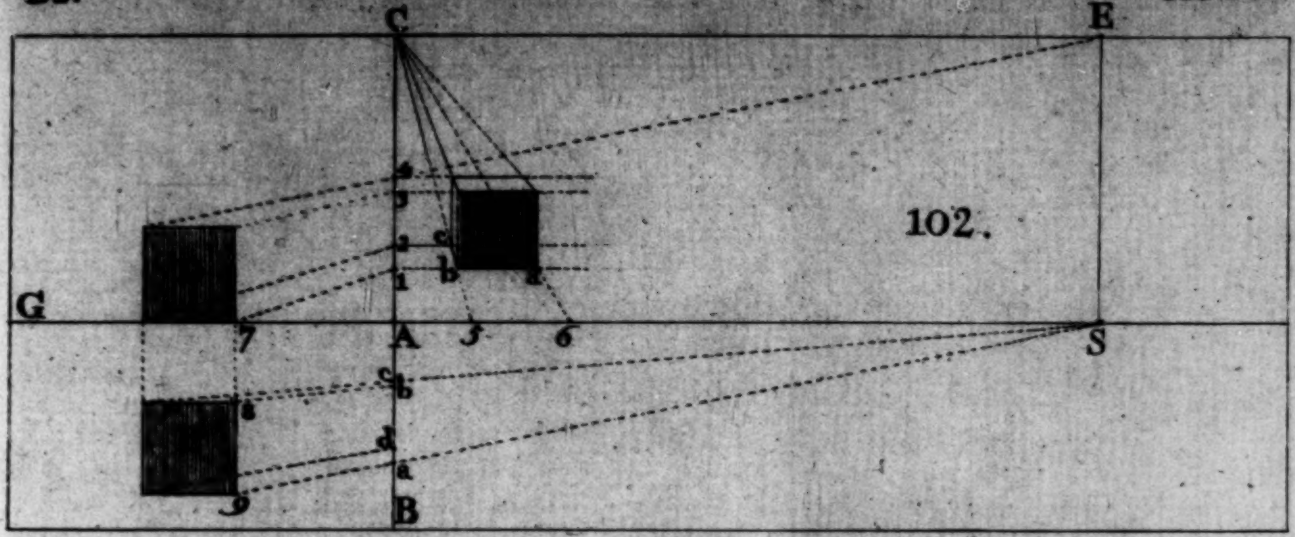


106.

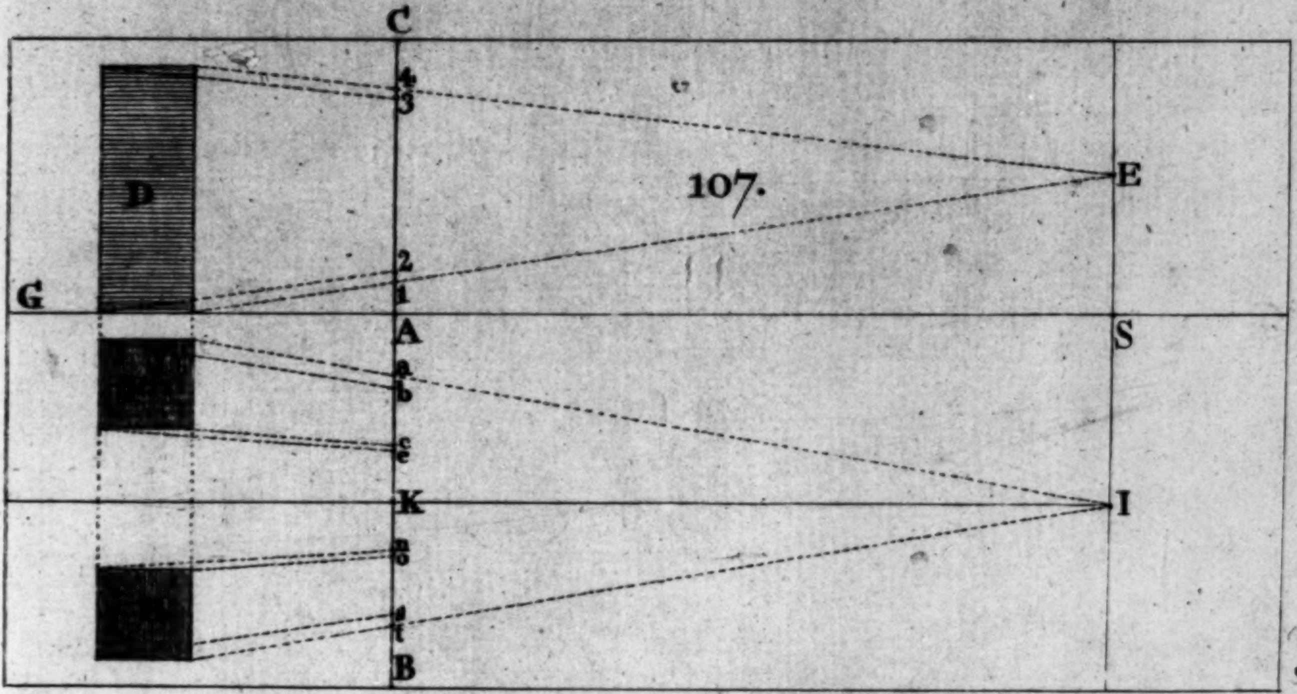


104.

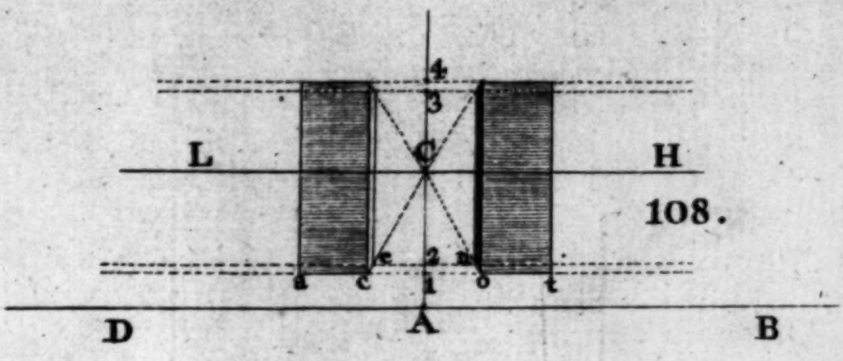
BRITISH
1 JY64
MUSEUM


C
E
4
3
2
1
c
b
a
G
7
A
5
6
S
c
b
8
d
a
9
B

102.


C
4
3
D
E
2
1
G
A
S
a
b
c
e
K
I
n
o
s
t
B

107.


4
3
L
C
H
e
2
n
a
c
1
o
t
D
A
B

108.

BRITISH
1 JY64
MUSEUM

3.